DOCUMENT RESUME

ED 383 523 SE 054 422

TITLE Science, Levels 7-12. Secondary Core Curriculum Standards.
INSTITUTION Utah State Board of Education, Salt Lake City. Div. of Curriculum and Instruction.
PUB DATE 92
NOTE 86p.; Cover title varies: Core Curriculum: Science. 1991, Grades 7-12.
PUB TYPE Guides - Classroom Use - Teaching Guides (For Teacher) (052) -- Guides - Non-Classroom Use (055)

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS Biology; Chemistry; *Graduation Requirements; Physics; *Science Curriculum; Science Education; Secondary Education; State Curriculum Guides; *Technology Education
IDENTIFIERS *Utah

ABSTRACT

This document presents the core science curriculum standards which must be completed by all students as a requisite for graduation from Utah's secondary schools. Contained within are the elementary and secondary school program of studies and high school graduation requirements. Each course entry for grades 7-12 contains: course title, unit of credit, prerequisites, course description, core standards of the course, and objectives. Course titles for grades 7-8 are: Life Science, Earth-Space, and Physical Science. Course titles for grades 9-12 are: Biological-Earth Science, Biology, Animal Science and Technology, Plant and Soil Science and Technology, Human Biology, Physical-Earth Science, Chemistry, Physics, and Principles of Technology I. (MKR)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 383 523

Core Curriculum
Science

Grades 7-12

1991

Utah State Board of Education

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
R. Raphael
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☑ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

SE 054 422

BEST COPY AVAILABLE

SE

SECONDARY
CORE CURRICULUM STANDARDS

UTAH STATE BOARD OF EDUCATION

Levels 7 - 12

SCIENCE

©1992

Utah State Office of Education
Curriculum Section
250 East 500 South
Salt Lake City, Utah 84111

INTRODUCTION

Action by the State Board of Education in January 1984 established a policy requiring the identification of specific core curriculum standards which must be completed by all students K-12 as a requisite for graduation from Utah's secondary schools. This action was followed by three years of extensive work involving all levels of the education family in the process of identifying, trial testing, and refining these core curriculum standards for Utah's schools.

The core curriculum represents those standards of learning that are essential for all students. They are the ideas, concepts, and skills that provide a foundation on which subsequent learning may be built.

The core should be taught with respect for differences in learning styles, learning rates, and individual capabilities without losing sight of the common goals. Although the core curriculum standards are intended to occupy a major part of the school program, they are not the total curriculum of a level or course.

A LETTER
FROM THE UTAH STATE BOARD OF EDUCATION

What takes place in the thirteen years from kindergarten through the twelfth grade of public school is critical to each student's success in today's world. The new core curriculum standards have been developed to provide a solid foundation in education for students. They call for mastery of information, concepts, and skills in the subject areas of: language arts, library media mathematics, science, social studies, the arts, information technology, responsible healthy lifestyles, and applied technology education.

The world of the future will require less than one-fourth of the work force for the production of consumer goods and food items. The core standards are designed to prepare students for those changing times that will require knowledge and skills for living and competition in the informational age.

Sincerely,

Neola Brown
Ruth Hardy Funk
Keith T. Checketts
Donald G. Christensen
John M. R. Covey
C. Grant Hurst
Harold S. Jensen
V. Jay Liechty
Frances H. Merrill

THE ELEMENTARY AND SECONDARY SCHOOL PROGRAM OF STUDIES AND HIGH SCHOOL GRADUATION REQUIREMENTS

STATEMENT OF PHILOSOPHY

The primary goal of education is the development of individuals who possess the knowledge, skills, and human characteristics neccesary to enable them to live meaningfully as individuals and as positive contributors to society. To achieve this ultimate goal, the individual must be provided experiences to develop skills in language and thinking; scientific understanding; mathematics; historical perception; aesthetic appreciation; social interaction; movement, fitness, and health; and career competencies.

ELEMENTARY EDUCATION

The elementary school reaches the greatest number of students for a longer period of time during the most formative years of the school experience. This unparalleled responsibility makes it imperative that each elementary school be provided with effective leadership, meaningful standards, a balanced curriculum, sufficient means, and competent staff.

SECONDARY EDUCATION

The secondary school should provide the opportunity for every student to have a challenging educational experience which will prepare him/her to pursue a fulfilling and productive role in society, which both transmits and enhances our culture. A comprehensive curriculum with enough flexibility to strengthen individual talents and interests must be available for all students.

R300-700. The Elementary and Secondary School Core Curriculum and High School Graduation Requirements.

R300-700-1. Definitions.

A. "Board" means the Utah State Board of Education.

B. "IEP" means individual education program.

C. "Special assignment teacher" means a teacher assigned to:

(1) alternative school settings with self-contained classrooms in which the teacher must teach several subjects;

(2) teach homebound students with the expectation that several subjects will be covered by the same teacher; or

(3) necessarily existent small or rural schools with limited faculty and enrollment in which teachers must teach more than three core subjects.

R300-700-2. Authority and Purpose.

A. This rule is authorized under Article X, Section 3, of the Utah State Constitution which vests general control and supervision of the public education system in the State Board of Education, Section 53A-1-402(1) (b), U.C.A. 1953, which directs the Board to make rules regarding competency levels, graduation requirements, curriculum, and instruction requirements, and Section 53A-1-401(3), U.C.A. 1953, which allows the Board to adopt rules in accordance with its responsibilities.

B. The purpose of this rule is to specify the minimum core curriculum for the public schools and high school graduation requirements.

R300-700-3. General Requirements - Course Standards.

The Board establishes minimum course description standards and objectives for each course in the required general core. Course descriptions for required and elective courses are developed cooperatively by local school districts and the Utah State Office of Education. The descriptions shall contain mastery criteria for the course and shall stress mastery of the criteria rather than completion of predetermined time allotments for subjects. Implementation and assessment procedures are the responsibility of local school districts.

R300-700-4. General Requirements - Teacher Qualifications.

Teachers may not be assigned to teach any course unless, for the subject area to which they are assigned, they hold a current Utah teaching certificate endorsed in the subject area, have completed an undergraduate or graduate major or minor in the subject area, have completed a Board approved inservice program, or have demonstrated competency in the subject area.

R300-700-5. General Requirements - Special Assignment Teachers.

A. Special assignment teachers must hold a Basic or Standard Certificate with endorsement(s) for the course(s) which they are assigned to teach. In addition, personnel must have completed at least nine quarter hours of state approved college or inservice course work in each of the subject areas in which they are assigned.

B. Special assignment teachers are temporarily authorized for the duration of their special assignment and do not receive a permanent endorsement for the subject area until they have completed the equivalent of a subject matter minor, at least 24 quarter hours of state approved college course work in the field, or have been

declared competent to teach the subject by the Utah State Office of Education Committee on Demonstrated Competency .

R300-700-6. General Requirements - Unit of Credit.

A. A unit of credit or fraction thereof shall be given upon satisfactory completion of a course or learning experience in compliance with state course standards. Students also may complete a course on a performance basis in which case assessment of mastery will be the responsibility of the local boards of education. Credit can be awarded only once for a specific required course with the same content during the secondary school experience.

B. Credit may be earned in any of the following ways:

(1) successful completion of a course;
(2) demonstrated proficiency, via pre-assessment;
(3) demonstrated mastery of approved courses outside of the school day or year;
(4) concurrent enrollment in approved post-secondary training institutions;
(5) demonstrated mastery of approved correspondence or extension courses; or
(6) upon application, demonstrated mastery in special experimental programs.

R300-700-7. General Requirements - Instructional Time.

School districts shall organize flexible time blocks for instruction which accommodate outcome-based curriculum. To help the Board keep apprised of instructional time variations, districts shall submit their instructional time schedule to the Utah State Office of Education for approval.

R300-700-8. General Requirements - Student Education Plan.

A student education plan is cooperatively developed by the student, the student's parents, and designated school personnel. This plan is guided by general requirements and individual student interests and goals. It is formally reviewed, at least, at the beginning of grade one, at the end of grades three and six, and annually thereafter. Each student's high school plan shall identify an area of concentration, which may be as many as four to five units, in a cluster related to the student's post-secondary goal.

R300-700-9. General Requirements - Diploma.

In Utah's public schools, a high school diploma is granted to a student who has met Board curriculum requirements and any additional requirements of the local school district.

R300-700-10. Requirements for Elementary Education.

A. The Board shall establish standards for elementary education which include the identification of a general core curriculum. Implementation and formal assessment of student mastery of the general core curriculum are the responsibilities of the local boards of education. At a minimum, formal assessment shall occur during or at the completion of the primary grades, grade three, and again during or at the completion of the intermediate grades, grade six. Informal assessment should occur on a frequent ongoing basis to ensure continual student progress. Provision for remediation for all students who do not achieve mastery is required.

B. Required Elementary Core Curriculum:

REQUIRED ELEMENTARY CORE CURRICULUM GRADES K-6	
GENERAL CORE Language Arts Reading Writing Speaking Listening Mathematics Science Social Studies Introductory Citizenship Principles and Practices The Arts Responsible Healthy Lifestyles Information Technology	**OPTIONS** Foreign Language

C. All handicapped students are required to demonstrate mastery of the core curriculum. If a student's handicapping condition precludes the successful demonstration of mastery, the IEP team, on a case by case basis, may exempt the student or modify the mastery demonstration to accommodate the student's handicap.

R300-700-11. Middle and High School Requirements.

A. The Board provides general direction and standards in secondary education. Students in grades seven and eight must earn a minimum of 12 units of credit. Students in grades nine through twelve must earn a minimum of 24 units of credit. Districts may required additional units of credit. Formal assessment of student mastery of the general core courses shall occur as a minimum during or at the completion of grades eight, ten, and twelve. Implementation and assessment of student mastery of the core courses are the responsibility of the local board.

B. Middle Education Core Curriculum:

GENERAL CORE - 10.5 Units PLUS REQUIRED ELECTIVES - 1.5	
SUBJECT AREAS	**REQUIREMENTS**
Language Arts	2.0 Local District Option
Mathematics	2.0
Science	1.5
Social Studies	1.5
The Arts	1.0
Responsible Healthy Lifestyles	1.5
Information Technology	Credit Optional
Applied Technology Education	1.0

C. High School Core Curriculum:
(1) Required credits.

HIGH SCHOOL CORE CURRICULUM
GRADES 9-12 -- 24 UNITS OF CREDIT REQUIRED

GENERAL CORE - 14.5 Units PLUS REQUIRED ELECTIVES - 9.5

SUBJECT AREAS	REQUIREMENTS
Language Arts	3.0
Mathematics	2.0
Science	2.5
1 Biological	
1 Physical	
Social Studies	3.0
The Arts	1.5
Responsible Healthy Lifestyles	2.0
Information Technology	Credit Optional
Applied Technology Education	1.0
Selected Electives	9.5

(2) Any state-approved applied technology course, or the applied technology core course fulfills the applied technology education requirement.

(3) Selected electives units of credit provide a means for specialization related to student interest and post-secondary goals.

(a) College Entry Cluster:

Foreign Language	2.0 units of credit
Mathematics	1.0 unit of credit
Science	1.0 unit of credit
Electives	4.5 units of credit

(b) Applied Technology job Entry Clusters:
(Select one)

Technical Emphasis	4.0 units of credit
Applied Technology Emphasis	5.0 units of credit
Computer Science	.5 unit of credit

(c) Electives: 4.0 - 5.0 units of credit

D. Information Technology standards in the middle education and high school core curriculum may be taught either by integrating them into other areas of the curriculum or in a specific class. Integration requires the district to submit a plan detailing at what level and in which class each standard will be taught. Districts establishing a specific class may offer .5 unit of credit.

E. All handicapped students are required to demonstrate mastery of the courses in the middle education and high school general core. If a student's handicapping condition precludes the successful demonstration of mastery, the IEP team, on a case by case basis, may exempt the student or modify the mastery demonstration to accommodate the student's handicap.

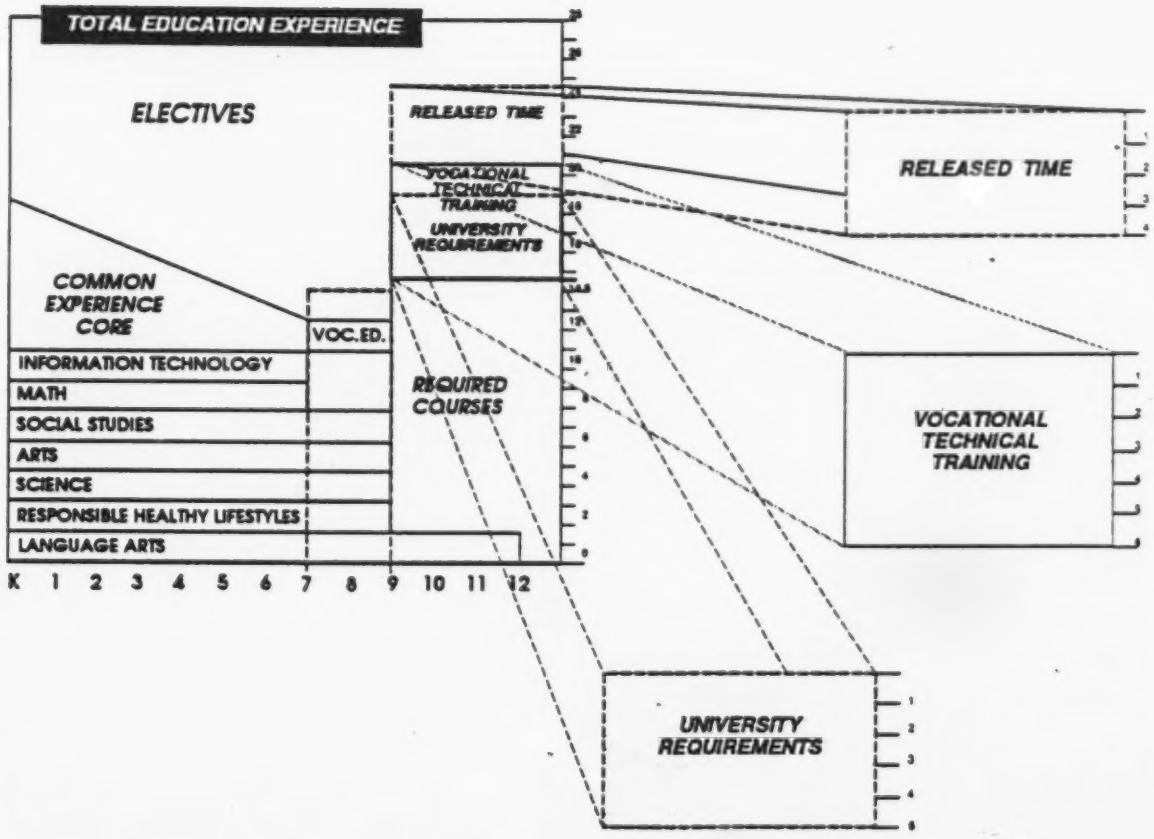
KEY: Curricula **Art X Sec. 3**
1989 **53A-1-402(1)(b)**
53A-1-401(3)

CORE COMPLETION GUARANTEES STUDENT ACCESS

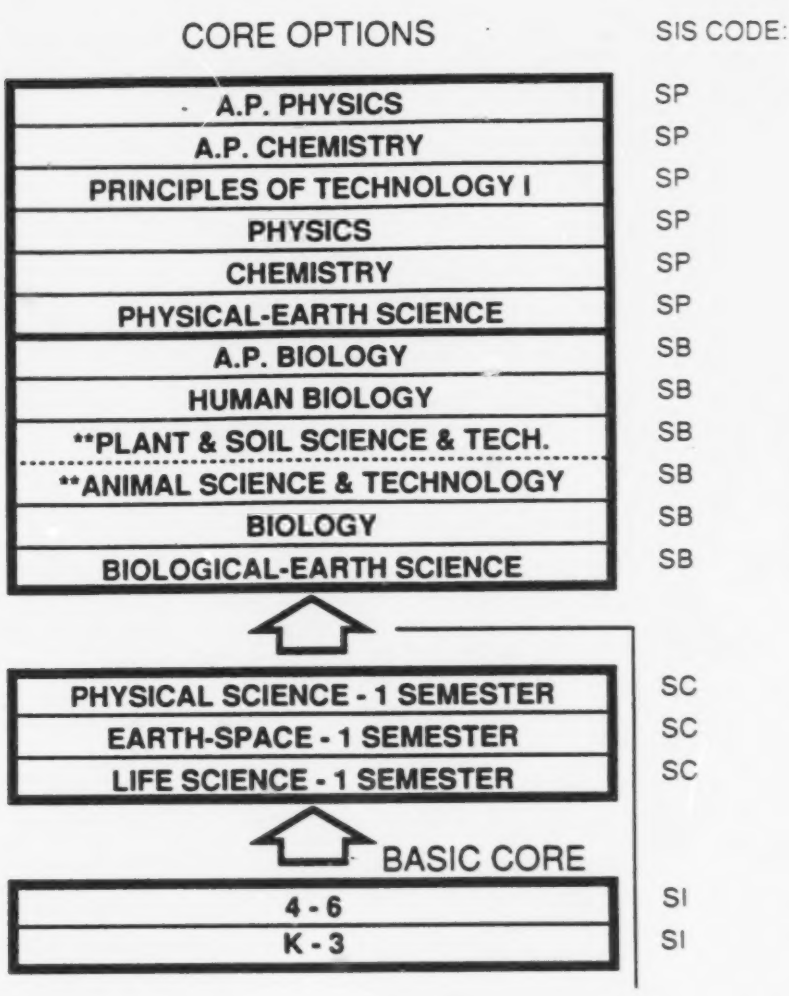
1. Guarantees common experience which forms the foundation skills.

2. Guarantees access to jobs and entry into college or vocational-technical education through required course completion.

3. Permits intensive vocational-technical education, entry into research universities, and a released-time component through specialization options.



SCIENCE COURSE CHART



*In the event that a student's SEP indicates the intent to specialize in an area of science in which training in both areas -- biological and physical -- would not be essential, the district may approve on an individual basis, two biological or two physical science courses to fulfill the high school science core requirements.

**Successful completion of BOTH "Animal Science and Technology" and "Plant and Soil Science and Technology" is required to satisfy the core requirement in biological science. Two units of credit will be granted, one in biological science and one in vocational education.

SCIENCE

The need to impart to all students some familiarity with modern science has come to assume major importance beyond the traditional education. Even if their future goals and occupations should be far removed from scientific fields, all of today's students will have to live in a world increasingly dominated by the rapid proliferation of its technological consequences. Furthermore, they will often be called upon to make decisions involving scientific considerations which could significantly affect the quality of life in our society.

Science should help students to live meaningfully and responsibly in a changing world, to perceive that there is order in the universe--that cause and effect relationships are present everywhere, to learn to search for answers and to question the accuracy and validity of those answers, to understand the importance of living their lives in harmony with all of nature's other creatures, and to relate the concepts of science to the practical application in future employment choices and careers.

The science core may be taught in a variety of ways, and the scope and sequence within a level or course is not "sacred." The approach has been to give students instruction in the life, earth-space, and physical sciences in a spiral format in grades K-6; in grades 7-8 these areas are covered in semester courses; and in grades 9-12 the requirement is for one biological science course and one physical science course from a selected group of core options.

Critical to the science instruction given Utah students is the need to involve **active** science inquiry. The processes of science--observing, classifying, inferring, predicting, measuring, communicating, using space/time relations, defining operationally, formulating hypotheses, experimenting, recognizing variables, interpreting data, formulating models--are as essential to student learning as the content and concepts. The laboratory and outdoor classroom are excellent settings for instructing these process skills.

To teach science effectively, it must be taught **safely.** Instruction and practice in safe handling of materials and equipment is a paramount responsibility of the science teacher. Safety is preventing an accident which might result in injury, not merely dealing with the accident after it has occurred.

The science core focuses on the **"what"** not the "how" or "when." Teachers should note that the core does not constitute the whole content of any grade level or course and represents a minimal requirement. The teacher develops the sequence for instruction and determines methodology, subject matter, resources, references, projects, and media for students.

SCIENCE LEVEL 7-8

COURSE TITLE	UNIT OF CREDIT	PREREQUISITE
Life Science	0.5	Mastery of Science through Level 6

LIFE SCIENCE

SIS COURSE NUMBER: 3200
SIS CODE: SC

COURSE DESCRIPTION

The 0.5 unit life science course in the Level 7-8 core is a foundation course which emphasizes the broad perspective of life science rather than specific, theoretical details. The content of the course centers on life, its characteristics, and the relationships that take place among living things. Specifically, the students will use the science process skills to investigate observable properties of living things, interrelationships among them, how they reproduce, and why they live where they do. The course has a hands-on orientation in which students learn and use the basic life science laboratory skills.

CORE STANDARDS OF THE COURSE

STANDARD 3200-01	**The students will demonstrate a knowledge of scientific methods and conduct experiments in life science.**

OBJECTIVES

3200-0101. List processes used in solving problems scientifically and identify ways to collect and record data.

3200-0102. Differentiate between a hypothesis and a theory.

3200-0103. Formulate a hypothesis in life science, based on observing life around them. Test the hypothesis.

3200-0104. Define observation, interpretation, and inference.

3200-0105. Manipulate a variable in a controlled experiment.

3200-0106. Formulate conclusions from a graph or table.

3200-0107. Write a scientific report of an experiment.

STANDARD 3200-02	The students will demonstrate an understanding of the characteristic processes of life.

OBJECTIVES

3200-0201. Describe the processes characteristic of all life: reproduction, movement, assimilation, growth, response, and energy transformation.

3200-0202. Explain the differences between living and non-living things.

STANDARD 3200-03	The students will draw, label, and interpret cell models.

OBJECTIVES

3200-0301. Draw plant and animal cells, note their differences and similarities, and label the cell parts.

3200-0302. Describe the functions of the following cell parts: nucleus, chromosomes, cell membrane, vacuole, mitochondria, cytoplasm, cell wall, and chloroplasts.

3200-0303. Observe microscopic slides of various living cells; e.g., cheek, onion, blood.

3200-0304. Recognize that all cells reproduce by dividing.

3200-0305. Describe mitosis.

3200-0306. Recognize that all living things are made of cells.

3200-0307. Perform experiments demonstrating the processes of diffusion and osmosis.

STANDARD 3200-04	The students will discover basic processes of photosynthesis and cellular respiration.

OBJECTIVES

3200-0401. Describe photosynthesis in terms of the starting materials, the role of light, the role of chlorophyll, and the end products.

3200-0402. Perform experiments illustrating the process of photosynthesis.

3200-0403. Explain the dependence of cellular respiration upon the process of photosynthesis.

3200-0404. Describe cellular respiration in terms of starting materials and end products.

3200-0405. Recognize that cellular respiration provides the energy needed for all life processes.

STANDARD 3200-05	**The students will examine the effects of heredity upon organisms.**

OBJECTIVES

3200-0501. Explain the differences between mitosis and meiosis in terms of the change in chromosome number at the end of each process.

3200-0502. Match terms and symbols used in genetics with their definition; e.g., genotype, phenotype, hybrid, XX, XY, chromosome, genes, trait, dominant, and recessive.

3200-0503. Predict offspring of monohybrid crosses.

3200-0504. Identify organisms that have been bred to improve production or increase their economic importance.

3200-0505. Explain and give examples of natural selection, artificial selection, mutation, and adaptation.

STANDARD 3200-06	**The students will recognize the basis for standard classification schemes and use them to group plants and animals.**

OBJECTIVES

3200-0601. Explain the need for a scientific system of classifying and naming living organisms.

3200-0602. List in the proper sequence the seven major categories used in classifying plants or animals.

3200-0603. Observe and compare major characteristics of the five kingdoms.

3200-0604. Classify selected organisms into the proper kingdom according to their similarities or differences.

3200-0605. Identify plants as vascular or nonvascular.

3200-0606. Classify invertebrates into phyla and give characteristics of each.

3200-0607. Classify vertebrates into classes and give characteristics of each.

STANDARD 3200-07	The students will investigate the ecological relationships between living things and their environments.

OBJECTIVES

3200-0701. Illustrate the flow of energy and matter among organisms in food chains, webs, and pyramids through a variety of diagrams, models, and investigations.

3200-0702. Explain the relationship among organisms in a biological community by defining the roles (producer, consumer, decomposer) of the organisms and their ecological niches within the habitat.

3200-0703. Name the components of the water, carbon, nitrogen, and oxygen cycles; and explain the importance of each cycle.

3200-0704. Identify the major biomes and examine relationships between abiotic and biotic factors in the biomes; e.g., desert, tropical rain forest, tundra, grassland, coniferous forest, temperate deciduous forest.

STANDARD 3200-08	The students will investigate ways in which man's impact upon the environment affects living things.

OBJECTIVES

3200-0801. Explain how increases in the human population affect the environment.

3200-0802. Distinguish between renewable and non-renewable resources.

3200-0803. Give examples of extinct and endangered species of both plants and animals.

3200-0804. Discuss some conservation practices for wildlife.

STANDARD 3200-09	The students will explore the career opportunities in the life sciences.

OBJECTIVES

3200-0901. Investigate careers in the life sciences.

SCIENCE LEVEL 7-8

COURSE TITLE	UNIT OF CREDIT	PREREQUISITE
Earth-Space	0.5	Mastery of Science through Level 6

EARTH-SPACE

SIS COURSE NUMBER: 3220
SIS CODE: SC

COURSE DESCRIPTION

The 0.5 unit earth-space science course in the Level 7-8 core is a foundation course which emphasizes the broad perspective of earth-space science rather than specific, theoretical details. Students will increase their understanding of the principles of science that control the earth and the universe, the forces that produce the unending changes of the earth's surface, and the effective use of renewable and non-renewable resources. Specifically, the student will use the science process skills to investigate observable properties of rocks and minerals, forces of erosion, soil, landforms, weather, and astronomy. Learning activities are varied with an emphasis-on student laboratory activities.

CORE STANDARDS OF THE COURSE

STANDARD 3220-01	**The students will demonstrate a knowledge of scientific methods and will conduct experiments in earth-space science.**

OBJECTIVES

3220-0101. List processes used in solving problems scientifically and identify ways to collect and record data.

3220-0102. Formulate and test a hypothesis in earth-space science.

3220-0103. Manipulate a variable in an experiment.

3220-0104. Plot data from experiments on graphs, charts, or other displays.

3220-0105. Formulate conclusions based upon the investigation.

STANDARD 3220-02	**The students will identify rocks and classify them according to origin.**

OBJECTIVES

3220-0201. Define: igneous, metamorphic, and sedimentary.

3220-0202. Communicate knowledge of the rock cycle through models, diagrams, or demonstrations.

3220-0203. Identify by name some common rocks from local strata.

3220-0204. Identify some characteristics of common igneous, sedimentary, and metamorphic rocks.

STANDARD 3220-03	**The students will identify the characteristics, composition, and use of common minerals.**

OBJECTIVES

3220-0301. Define mineral and describe some characteristics of common minerals.

3220-0302. Use a mineral key to identify some common minerals.

3220-0303. Demonstrate the following properties of minerals: cleavage, luster, streak, hardness, crystal structure, and specific gravity.

STANDARD 3220-04	**The students will relate the process of weathering, erosion, and deposition to soil building and water movement.**

OBJECTIVES

3220-0401. Distinguish among weathering, erosion, and deposition.

3220-0402. Differentiate between chemical and mechanical weathering.

3220-0403. Identify and describe the effects of erosion caused by water, wind, and glaciation.

3220-0404. Identify common types of deposition: deltas, moraines, and dunes. Describe characteristics of each.

3220-0405. Describe the effects of weathering, erosion, and deposition on streams and lakes.

STANDARD 3220-05	**The students will use the plate tectonics theory and the effects of internal forces of the earth to explain the earth's surface features.**

OBJECTIVES

3220-0501. Describe the theory of moving plates within the lithosphere.

3220-0502. Identify evidence that supports the existence of moving plates.

3220-0503. Explain the relationship between moving plates and earthquakes.

3220-0504 Identify the earth's layers and explain how earthquake shock waves travel through each layer.

3220-0505. Describe how moving plates can cause volcanic activity.

3220-0506. Infer how structural features such as mountains, plateaus, and faults may form.

STANDARD 3220-06	**The students will compare renewable and nonrenewable types of energy sources.**

OBJECTIVES

3220-0601. Identify sources of energy as being renewable or non-renewable.

3220-0602. Explain how fossil fuels, geothermal, wind, water, and nuclear energy sources result from natural earth processes.

3220-0603. Discuss the positive and negative aspects of using the energy sources in number 2.

3220-0604. Communicate ways to conserve renewable and non- renewable energy sources.

STANDARD 3220-07	**The students will investigate geologic history.**

OBJECTIVES

3220-0701. Review how fossils are formed.

3220-0702. Explain the importance of superposition.

3220-0703. Discuss the major events of the four geologic eras.

STANDARD 3220-08	**The students will describe natural factors that determine weather and climate.**

OBJECTIVES

3220-0801. Describe global air masses in terms of air pressure, wind patterns, temperature, and water content.

3220-0802. Discuss the origin and effects of cold fronts, warm fronts, and occluded fronts.

3220-0803. Identify causes and effects of local and prevailing winds.

3220-0804. Describe how mountains and large bodies of water influence the weather and climate.

3220-0805. Explain how temperature, humidity, and barometric pressure influence the weather and the climate.

3220-0806. Obtain and interpret readings from weather instruments measuring temperature, humidity, wind velocity and direction, and barometric pressure.

3220-0807. Identify causes and effects of human activity on the atmosphere and weather; e.g., the greenhouse effect, pollution, albedo.

3220-0808. Describe ways to avoid dangers related to severe weather conditions.

STANDARD 3220-09	**The students will investigate the solar system and the universe.**

OBJECTIVES

3220-0901. Identify the relative size and position of stars, planets, the solar system, galaxies, meteoroids, and comets.

3220-0902. Discuss the orbits and periods of comets.

3220-0903. Identify the conditions necessary for eclipses to occur.

3220-0904. Explain the causes and effects of rotation and revolution of bodies in the solar system.

3220-0905. Demonstrate the causes of the seasons on earth.

STANDARD 3220-10	**The students will indicate major events in man's exploration of space and explain the important role the events have played in advancing technology.**

OBJECTIVES

3220-1001. Discuss the development and importance of rockets, satellites, the space shuttle, and instruments to explore space.

3220-1002. Discuss innovations in areas such as radio astronomy, solar energy, medicine, communications, and materials development that have come from the space program.

STANDARD 3200-11	**The students will explore the career opportunities in the earth-space sciences.**

OBJECTIVES

3220-1101. Investigate careers in the earth-space sciences.

SCIENCE LEVEL 7-8

COURSE TITLE	UNIT OF CREDIT	PREREQUISITE
Physical Science	0.5	Mastery of Science through Level 6

PHYS SCIENCE

SIS COURSE NUMBER: 3240
SIS CODE: SC

COURSE DESCRIPTION

The 0.5 unit physical science course in the Level 7-8 core is a foundation course which emphasizes the broad perspective of physical science rather than specific, theoretical details. The course centers on some observable properties of matter and energy. Specifically, the student will use the science process skills to investigate the properties of matter; elements, compounds, and mixtures; physical and chemical changes; forces and work; heat; light; sound; and electricity. Students learn by applying course content to phenomena and events in the real world, not by the memorization of information. Learning activities are varied with an emphasis on student laboratory investigations.

NOTE: **Even though heat and electricity have been dropped from the core curriculum of the core course, they are important basic concepts which can be covered if time permits.**

CORE STANDARDS OF THE COURSE

STANDARD 3240-01	**The students will demonstrate a knowledge of scientific methods and will conduct experiments in physical science.**

OBJECTIVES

3240-0101. List processes used in solving problems scientifically and identify ways to collect and record data.

3240-0102. Formulate and test a hypothesis in physical science.

3240-0103. Manipulate a variable in an experiment.

3240-0104. Plot data from experiments on graphs, charts, or other displays.

3240-0105. Formulate conclusions based upon the investigation.

STANDARD 3240-02	The students will identify physical and chemical properties of matter.

OBJECTIVES

3240-0201. Define matter and energy.

3240-0202. Identify the states of matter and describe ways that matter can change from one state to another.

3240-0203. Demonstrate chemical properties of matter such as acidity, basicity, combustibility, and reactivity.

3240-0204. Compare physical properties of various substances; e.g., shape, density, solubility, odor, melting point, boiling point.

3240-0205. Demonstrate density.

3240-0206. Describe the characteristics and give examples of: (a) elements, compounds, and mixtures; (b) acids, bases, and salts; (c) organic and inorganic substances.

3240-0207. Compare physical and chemical changes. Cite examples of each.

3240-0208. Explain how matter and energy are conserved in chemical and physical changes.

STANDARD 3240-03	The students will explain the structure of an atom.

OBJECTIVES

3240-0301. Discuss the atomic theory of matter.

3240-0302. Draw and explain the Bohr and cloud models of the atom.

3240-0303. Describe the electron, proton, and neutron in terms of their location in the atom, their charge, and their mass.

3240-0304. Illustrate how an element can become a positive ion. A negative ion. In each case, name the element and then the ion.

3240-0305. Define isotope and give examples.

3240-0306. Define nuclear fission and fusion.

STANDARD 3240-04	**The students will use a periodic chart for obtaining information about elements.**

OBJECTIVES

3240-0401. Explain the structure of a periodic chart and the arrangement of the elements on it.

3240-0402. Describe the relationship of the elements within periods and families on a periodic chart.

3240-0403. Distinguish in general terms between ionic and covalent bonding.

3240-0404. Using a periodic chart, compare the reactivity of some of the elements.

STANDARD 3240-05	**The students will investigate the basic principles and technological applications of force, motion, and work.**

OBJECTIVES

3240-0501. Explain how mass and weight differ.

3240-0502. Describe the effect of gravity on stationary and on moving objects.

3240-0503. Demonstrate and explain Newton's three laws of motion.

3240-0504. Identify conditions when forces are balanced and when they are unbalanced.

3240-0505. Operate the following types of machines and demonstrate how they make work easier: lever, pulley, inclined plane, wedge, screw, wheel, and axle.

3240-0506. Perform calculations using the equation: "work equals force times distance" and use the correct units.

3240-0507. Distinguish between: (a) speed and velocity, and (b) velocity and acceleration.

3240-0508. Apply the principles of force and motion to powered vehicles, rockets, projectiles, and restraining devices.

STANDARD 3240-06	The students will demonstrate and describe the properties of sound.

OBJECTIVES

3240-0601. Demonstrate longitudinal (compressional) and transverse waves and discuss their characteristics.

3240-0602. Describe how frequency of sound waves is related to musical sounds.

3240-0603. Demonstrate volume, pitch, and quality of sounds.

3240-0604. Discuss what causes echoes.

3240-0605. Demonstrate and discuss the interference of sound waves.

3240-0606. Explain the term "decibel" and describe the effects on an individual as the decibel level rises.

STANDARD 3240-07	The students will investigate the basic characteristics of light and its technological applications.

OBJECTIVES

3240-0701. Compare some characteristics of light waves to those of sound waves: relative speed, type of wave, medium required for travel.

3240-0702. Use a prism, a diffraction grating, etc., to produce a spectrum.

3240-0703. Explain what causes the colors to be dispersed.

3240-0704. Distinguish between colors in terms of wavelength and frequency.

3240-0705. Demonstrate and describe the images formed in (a) plane mirrors, (b) convex mirrors, (c) concave mirrors.

3240-0706. Use a ray diagram to show the path of light passing through: (a) a convex lens, and (b) a concave lens.

3240-0707. Compare the characteristics of real and virtual images.

3240-0708. Describe the use of lenses/mirrors in eyeglasses, cameras, microscopes, telescopes.

3240-0709. Identify the characteristics of light that make lasers possible.

STANDARD 3240-08	The students will explore the career opportunities in the physical sciences.

OBJECTIVES

3240-0801. Investigate careers in the physical sciences.

SCIENCE LEVEL 9-12

COURSE TITLE	UNIT OF CREDIT	PREREQUISITE
Biological-Earth Science (Core Option)	1.0	Mastery of Science through Level 8

BIOL EARTH

SIS COURSE NUMBER: 3500
SS CODE: SB

COURSE DESCRIPTION

The focus of this course in the high school core is practical rather than theoretical. Emphasis is on problem solving and scientific reasoning applied to real world problems integrating knowledge from the life and earth sciences. The primary focus of the course investigates the interrelationships between science principles, technological innovations, and societal impact (STS). Students develop the background necessary to understand and react responsibly to problems associated with: (1) the ecological interaction of the earth's living and nonliving environments; (2) the impact on these environments from people's lifestyles and technology; (3) population dynamics; (4) the field of biological engineering and its impact on society; and (5) cellular and evolutionary adaptations. Learning activities are varied with an emphasis on student investigations in the field, laboratory, library, career education, and current topics.

CORE STANDARDS OF THE COURSE

STANDARD 3500-01	**The students will recognize that interactions between the living and non-living environments result in a dynamic balance.**

OBJECTIVES

3500-0101. Observe firsthand a biotic community in a backyard, school ground, or neighborhood. List the living and nonliving parts, and show the interrelationships.

3500-0102. Organize the members of the biotic community you observed into a food web and identify the producers, consumers, and decomposers.

3500-0103. Identify an interaction between two organisms you studied in the observed community; e.g., mutalism, commensalism, parasitism, predation, scavenging, competition.

3500-0104. In the observed biotic community, describe where energy enters the living system, the direction of flow through it, and the overall loss of energy by each succeeding consumer level.

3500-0105. Diagram the cycles (water, carbon-oxygen, nitrogen, phosphate) present in the observed biotic community emphasizing interactions between both the living and nonliving parts.

3500-0106. Through experimentation or demonstration with light, temperature, water, soil, air, or topography, measure the physical interactions between any pair of these limiting factors (e.g., light versus temperature; light versus topography; water versus soil; water versus topography).

3500-0107. Interpret data relating to an organism's ability to tolerate gradients of limiting factors and relate this to the observed community.

3500-0108. Relate limiting factors to care and selection of plants and animals appropriate for home, agriculture, or space exploration.

3500-0109. Observing local ecosystems, determine the physical and topographic factors which cause the various communities.
Possible topics: soil, pH, north- and south-facing slopes, altitude, salinity, availability of water.

3500-0110. Given a list of plants, animals, and climatic conditions, identify the world biome in which these are found.

3500-0111. Place in successional order a list of life forms and physical changes that are involved in establishment of a stable community for each of the following: lake, rock, sand dune, vacant lot, and burned forest.

STANDARD 3500-02	**The students will investigate the impact of humans on the environment.**

OBJECTIVES

3500-0201. Collect data through observation, experimentation, and research which shows the impact of humans on air, land, and water.
Possible topics: water shortages, flooding, zoning laws (agriculture/subdivisions), off-road vehicle use, displaced deer habitat, greenhouse effect, chemical/nuclear waste dumps.

3500-0202. List possible sources and identify/describe the types of natural and human-made pollution in air, land, and water.
Possible topics: dust, silt, hydrocarbons, detergents, sewage, animal wastes, solid wastes, thermal wastes.

3500-0303. Evaluate possible technological solutions to natural and man-made pollution, emphasizing cleanup costs versus prevention.

3500-0204. Plan and share practical family or personal activities that minimize your impact upon the environment.

3500-0205. Analyze current trends and forecast the possible future of human's continued influence on air, land, and water.

3500-0206. Investigate and evaluate ways humans can alter patterns of succession for their use or detriment.
Possible topics: drainage of swamps, building on watersheds, altering stream flow, building dams, forest fires, grazing practices, fertilizers, irrigation, agriculture.

3500-0207. Distinguish between types of pest controls used around the home and community, and evaluate alternatives, including nonuse, biological controls, and pesticides.

3500-0208. Trace toxic chemicals through a food chain showing increases in concentration (biological magnification); e.g., mercury, lead, D.D.T.

3500-0209. Speculate about the quality of life humans would encounter without wildlife, wilderness, and other preserved lands.
Possible topics: endangered species, aesthetic needs of man.

3500-0210. Debate human responsibility for wildlife and land use management.
Possible topics: predator control, hunting and fishing values, overgrazing, tree farming, range management, species introduction, stream stocking, deer and elk feeding programs.

STANDARD 3500-03	**The students will investigate the principles of population dynamics.**

OBJECTIVES

3500-0301. Predict your impact on future population growth based on different numbers of children per family.

3500-0302. Sample the live population in a square meter of school ground or some other neighboring area. Organize the data into charts and graphs, and draw conclusions. Make predictions from the gathered information about doubling time.

3500-0303. Assess the importance of births, deaths, migration, and carrying capacity on population growth or decline.

3500-0304. Identify some of the possible effects of changes in population as related to environmental quality, technology, food, living space, overgrazing, medical health, sanitation, industrialization, and resource management.

3500-0305. Use census information to determine population trends in the state,

nation, and world and project the impact of these trends on your potential standard of living.

3500-0306. Draw conclusions about the relationship between population determiners (natality, mortality, migration) and the length of time required to double the population.
Possible topics: cancer cure, heart replacement, increase of wars, AIDS increase.

STANDARD 3500-04	**The students will investigate cells and the basic processes of cellular energy conversion.**

OBJECTIVES

3500-0401. Compare a cell to some component of your community. Examine the relationship of your identified component to a cell in an organism.
Possible topics: movement of materials, energy flow, structure, regulations.

3500-0402. From living material, prepare a slide, observe and identify the basic cell components. Include cell membrane/wall, cytoplasm, nucleus, and other organelles.

3500-0403. Relate the process of cell division to reproduction, growth, healing, and tissue repair.

3500-0404. Trace the transformation and use of energy and earth materials by life forms.
Possible topics: photosynthesis, transpiration, respiration, cell diffusion.

3500-0405. Evaluate the impact of technology in increasing the amount and varieties of food and biofuels.

3500-0406. Assess the value of health technology devices and procedures.
Possible topics: implants, transplants, kidney dialysis, life support, lasers.

STANDARD 3500-05	**The students will investigate the principles of genetics and their applications.**

OBJECTIVES

3500-0501. Relate the principles of genetics to the inheritance of human traits and the improvement and variation of plants and animals.
Possible topics: case studies of classroom surveys, PTC tasting, earlobe attachment, tongue rolling, blood types, animal pedigrees, agricultural plants, animals.

3500-0502. Identify from the chromosome make-up (karyotype), the following chromosome abnormality syndromes and describe their characteristics: Down's syndrome, Turner's syndrome, Klienfelter's syndrome, XXX, XYY.

3500-0503. Assess the relative importance of heredity and environment in humans.
Possible topics: criminality, I.Q., behavior.

3500-0504. Describe in general terms the process of genetic engineering at the DNA level and defend its present and future implications.
Possible topics: correcting defective genes, designer genes, gene splicing.

3500-0505. Discuss the effects of the prebirth environment on the fetus and the role of genetic counseling.
Possible topics: correcting defective genes, designer genes, gene splicing.

3500-0506. Describe the technological basis and debate the ethical concerns of manipulating the process of fertilization.
Possible topics: artificial insemination, invitro fertilization, cloning, surrogate mothers, sperm banks.

STANDARD 3500-06	**The students will describe and interpret the fossil record as a key to the past, the present, and a prelude to the future.**

OBJECTIVES

3500-0601. Speculate about the possible changes in life forms that may occur in the future as the result of natural and artificial selection.
Possible topics: disease resistant plants, faster/better producing animals, smarter humans.

3500-0602. Identify the various ways that fossils are formed and evaluate the theories used to explain the fossil record in geologic time.
Possible topics: natural selection, Darwin's theory, Lamark's theory.

3500-0603. Use fossils and geologic principles, superposition, uniformitarianism, geological dating, fossil formation processes, sedimentation, mountain building, climatic history changes to describe and interpret Utah's geological history.

3500-0604. Explore the relationship/impacts of fossils on modern technology
Possible topics: diatomaceous filters, fuel exploration, coal derivatives, chalk, building materials (limestone), semiprecious/precious stones.

STANDARD 3500-07	**The students will select three objectives from this course and apply each of these objectives in a job or work setting.**

OBJECTIVES

3500-0701. Describe how each of three selected objectives is applied or used in a job or work setting.

3500-0702. Select a job or work setting and show how the science concepts of this course has changed the manner in which work has been done in that job or setting.

3500-0703. Solve a problem applied to a job or work setting for each of three objectives from this course.

SCIENCE LEVEL 9-12

COURSE TITLE	UNIT OF CREDIT	PREREQUISITE
Biology (Core Option)	1.0	Mastery of Science through Level 8

BIOLOGY

SIS COURSE NUMBER: 3520
SIS CODE: SB

COURSE DESCRIPTION

The one unit biology course in the high school core exposes students to a wide range of biological science topics in ecology, heredity and genetics, molecular biology, diversity of life, and change through time. The science processes of observation, measurement, hypothesizing, data gathering and interpretation, analysis, and application are stressed. Career opportunities in the biological sciences are examined. Learning activities are varied with an emphasis on student laboratory investigations.

NOTE: **Standards 2-4 emphasize that all life is unified by a number of basic similarities or patterns (UNITY); standards 5-7 that life today is a continuation, with some changes, of life in the past (CONTINUITY); standards 8-9 that modification of life patterns results in a diversity among organisms (DIVERSITY); and standards 10-11 that patterns of interaction exist between organisms and their environment (INTERACTION).**

CORE STANDARDS OF THE COURSE

STANDARD 3520-01	**The students will demonstrate proper laboratory skills.**

OBJECTIVES

3520-0101. Demonstrate the safe use of biological equipment and selected chemicals.

3520-0102. Properly use a microscope and other biological equipment and materials.

STANDARD 3520-02	**The students will discover that the cells of living organisms are composed of essentially the same substances. (CELL CHEMISTRY)**

OBJECTIVES

3520-0201. Distinguish between the terms element, molecule, and compound as they relate to living systems.

3520-0202. Explain the nature and role of the following essential molecules in cells: carbohydrates, fats, proteins, nucleic acids, and enzymes.

STANDARD 3520-03	**The students will recognize that organisms have basic structural and functional properties at the cellular level. (CELL STRUCTURE AND FUNCTION)**

OBJECTIVES

3520-0301. Summarize the function of each of the organelles within a plant/animal cell.

3520-0302. Discuss the following processes relating to the cell:

a. Diffusion
b. Osmosis
c. Active Transport

3520-0303. Explain cell division and describe the phases of mitosis.

3520-0304. Recognize that cells are the foundation of higher levels of organization; e.g., tissues, organs, systems.

STANDARD 3520-04	**The students will describe a number of biochemical pathways that are common to all living organisms. (CELL ENERGY)**

OBJECTIVES

3520-0401. Distinguish between autotrophs and heterotrophs.

3520-0402. Explain the role of ATP as the source of cell energy.

3520-0403. Compare the flow of energy through photosynthesis and respiration.

3520-0404. Differentiate between aerobic and anaerobic respiration.

STANDARD 3520-05	**The students will investigate the patterns by which organisms reproduce to preserve the species. (REPRODUCTION)**

OBJECTIVES

3520-0501. Contrast sexual and asexual reproduction.

3520-0502. Illustrate/explain meiosis and its importance in sexual reproduction.

STANDARD 3520-06	The students will explain the passage of hereditary information by a genetic code. (HEREDITY)

OBJECTIVES

3520-0601. Assess the contributions of Gregor Mendel and others in the field of heredity.

3520-0602. Describe the structural framework of DNA and recognize its role as the basis of the genetic code.

3520-0603. Discuss the role of DNA in protein synthesis.

3520-0604. Define the following terms:

a. Pure breeding
b. Dominant trait
c. Recessive trait
d. P1, F1, F2 generations
e. Hybrid
f. Monohybrid
g. Dihybrid
h. Phenotype
i. Genotype
j. Homozygous
k. Heterozygous
l. Genes and chromosomes
m. Allele
n. Gamete
o. Incomplete dominance
p. Mutation

3520-0605. Solve genetic problems involving monohybrid and dihybrid traits.

3520-0606. Demonstrate how probability is involved in predicting the inheritance of traits.

3520-0607. Identify the genetic basis for sex determination.

3520-0608. Solve genetic problems involving sex-linkage.

STANDARD 3520-07	The students will describe and interpret current and historical scientific theories on the origin of life and organic variation. (EVOLUTION)

OBJECTIVES

3520-0701. Assess the contributions of Charles Darwin and others to evolutionary theory.

3520-0702. Compare various theories on the origin of life.

3520-0703. Describe how the fossil record is used to support the idea that organisms evolve and that organisms living today are descendants of earlier life forms.

3520-0704. Identify how natural selection acts as the vehicle for evolution.

3520-0705. Discuss how the following evolutionary mechanisms relate to organic variation:

a. Adaptation
b. Mutation
c. Isolation
d. Migration

STANDARD 3520-08	**The students will classify organisms by comparing similarities and differences in their structure. (CLASSIFICATION)**

OBJECTIVES

3520-0801. Investigate structural similarities as a basis for classification.

3520-0802. Explain and illustrate, with examples, the binomial system of scientific naming.

3520-0803. Classify organisms using a dichotomous key.

STANDARD 3520-09	**The students will cite evidence that living things progress from simple to complex organization resulting in a variety of life. (DIVERSITY)**

OBJECTIVES

Protists, Fungi, Monera

3520-0901. Describe and compare the characteristics which identify the protists, fungi, and monera.

3520-0902. Evaluate several beneficial and harmful effects of protists, fungi, and monera as they relate to humans.

Plants

3520-0903. Describe and compare the characteristics of algae, bryophytes, and tracheophytes.

3520-0904. Discuss alternation of generations in plants as a reproductive method.

3520-0905. Contrast the differences between monocots and dicots.

3520-0906. Evaluate several beneficial and harmful effects of plants as they relate to humans.

Animals

3520-0907. Describe and compare the characteristics of major invertebrate phyla and the diversity within each.

3520-0908. Describe and compare characteristics of major vertebrate classes and the diversity within each.

3520-0909. Evaluate several beneficial and harmful effects of animals as they relate to humans.

STANDARD 3520-10	**The students will explain how continual interactions between the living and nonliving environment result in a dynamic balance within an ecosystem. (ECOLOGICAL RELATIONSHIPS)**

OBJECTIVES

3520-1001. Identify the role of abiotic factors (temperature, moisture, nutrient cycles, etc.) in an ecosystem.

3520-1002. Identify the biotic factors (producers, consumers, food webs, etc.) in an ecosystem.

3520-1003. Relate the following to an ecosystem:

a. Biome
b. Community
c. Niche
d. Population
e. Habitat
f. Succession

STANDARD 3520-11	**The students will observe that a natural balance between organisms and their environment can be altered by natural or man-controlled events. Cite examples. (BALANCE OF NATURE)**

OBJECTIVES

3520-1101. Recognize ways that humans have changed the abiotic and biotic factors in the biosphere such as pollution, invasion, alterations, etc.

3520-1102. Evaluate an individual's place in and responsibility to the ecosystem.

STANDARD 3520-12	**The students will select three objectives from this course and apply each of these objectives in a job or work setting.**

OBJECTIVES

3520-1201. Describe how each of three selected objectives is applied or used in a job or work setting.

3520-1202. Select a job or work setting and show how the science concepts of this course has changed the manner in which work has been done in that job or setting.

3520-1203. Solve a problem applied to a job or work setting for each of three objectives from this course.

SCIENCE LEVEL 9-12

COURSE TITLE	UNIT OF CREDIT	PREREQUISITE
Animal Science and Technology	1*	Mastery of Science through Level 8

BIO-ANSCTECH

CIP 02.0201
SIS COURSE NUMBER: 3540
SIS CODE: SB/VO

COURSE DESCRIPTION

This course exposes students to a wide range of scientific principles in: genetics, anatomy, physiology/nutrition, diseases, pests, and management practices. The science processes of observation, measurement, hypothesizing, data gathering, interpretation, analysis, and application are stressed. Career opportunities and educational preparation are examined. Learning activities are varied with classroom, laboratory, and field experiences emphasized.

NOTE: ***Successful completion of BOTH "Animal Science and Technology" and "Plant and Soil Science and Technology" is required to satisfy the core requirement in biological science. Two units of credit will be granted, one in biological science and one in vocational education. A subject specific endorsement in biological science (7-12) is required for satisfaction of the science credit.**

CORE STANDARDS OF THE COURSE

STANDARD 3540-01	**The students will discover the relationship of the Future Farmers of America (F.F.A.) history.**

OBJECTIVES

3540-0101. Outline and determine the basic history of the F.F.A.

3540-0102. Become aware of the basic aims and purposes of the F.F.A.

3540-0103. Develop leadership qualities for personal goals.

STANDARD 3540-02	The students will demonstrate proper laboratory skills.

OBJECTIVES

3540-0201. Demonstrate the safe use of biological equipment and selected chemicals.

3540-0202. Properly use a microscope and other biological equipment and materials.

STANDARD 3540-03	The students will discover the chemistry, structure, function, and energy of living cells.

OBJECTIVES

3540-0301. Understand the composition and interaction of matter.

3540-0302. Explain the role of carbohydrates, fats, proteins, nucleic acid, and enzymes in living cells.

3540-0303. Summarize the function of each cell part or organelle.

3540-0304. Discuss cell processes:

a. Diffusion
b. Osmosis
c. Mitosis
d. Meiosis
e. Active transport

3540-0305. Recognize levels of cell organization: tissues, organs, systems.

3540-0306. Distinguish between:

a. Aerobic and anaerobic
b. Autotrophs and heterotrophs

3540-0307. Explain the role of ATP in cell energy.

STANDARD 3540-04	The students will classify animals by comparing similarities and differences.

OBJECTIVES

3540-0401. Investigate structural similarities as a basis for classification.

3540-0402. Explain the binomial system of classification by using examples.

3540-0403. Classify organisms by using dichotomous key.

STANDARD 3540-05	**The students will describe theories on the origin of life and organic variation.**

OBJECTIVES

3540-0501. Discuss how the following evolutionary mechanisms relate to organic variation:

a. Adaptation
b. Mutation
c. Isolation
d Natural selection
e. Migration
f. Variation
g. Genetic drift
h. Hybridization

3540-0502. Compare various theories on the origin of life including the fossil records.

3540-0503. Assess contributions of Charles Darwin and others.

STANDARD 3540-06	**The students will cite evidence that living things progress from simple to complex organisms.**

OBJECTIVES

3540-0601. Compare and contrast the characteristics of major invertebrate phyla and diversity within each.

3540-0602. Describe and compare characteristics of major vertebrate classes and diversity of each.

3540-0603. Evaluate beneficial and harmful effects of animals as they relate to humans.

STANDARD 3540-07	**The students will explain the passage of hereditary information by a genetic code (heredity).**

OBJECTIVES

3540-0701. Assess the contributions of each of the following to heredity:

a. Gregor Mendel
b. Thomas Morgan

3540-0702. Describe the structural framework of DNA and RNA as the basis of genetic code.

3540-0703. Discuss the processes of DNA replication, transcription, and protein

synthesis and gene regulation (operons).

3540-0704. Define the following terms:

a. Pure breeding
b. Dominance
c. Recessive trait
d. P1, F1, F2 generation
e. Hybrid
f. Monohybrid
g. Dehybrid
h. Phenotype
i. Genotype
j. Homozygous
k. Heterozygous
l. Gene and chromosome
m. Gamete
n. Incomplete dominance
o. Allele
p. Mutation
q. Codominance

3540-0705. Solve genetic problems (monohybrid and dehybrid crosses, probability, sex determination, and sex controlled traits).

STANDARD 3540-08	**The students will investigate the patterns by which organisms reproduce to preserve the species.**

OBJECTIVES

3540-0801. Illustrate meiosis and its importance in sexual reproduction and evolution.

3540-0802. Contrast sexual and asexual reproduction.

3540-0803. Understand the anatomy and physiology of the reproductive organs:

a. Parthenogenesis
b. Reproductive organs of female
c. Reproductive organs of male

3540-0804. Understand hormonal control of mammalian reproduction.

3540-0805. Illustrate results of ova transplant and superovulation.

3540-0806. Understand the importance of artificial insemination in animals serving mankind.

STANDARD 3540-09	**The students will investigate and describe animal anatomy and physiology.**

OBJECTIVES

3540-0901. Be able to select animals for form and function.

3540-0902. Be able to identify anatomical and physiological components including bones, muscles, organs, etc.

3540-0903. Describe the interrelationships among physiological systems; i.e., circulatory, respiratory.

3540-0904. Demonstrate animal health practices such as crude surgery, vaccines, control of external and internal parasites.

STANDARD 3540-10	**The students will explain why animal nutrition is important.**

OBJECTIVES

3540-1001. Discuss the development of the digestive systems from simple animals to complex animals.

3540-1002. Compare digestive systems of monogastric and polygastric animals.

3540-1003. Compare average capacities of digestive tracts of selected animals.

3540-1004. Outline digestive processes in animals; i.e., enzyme action, region of digestion, end product.

3540-1005. Determine nutrient requirements of animals that serve mankind.

3540-1006. Explain the function and organization of each of the following:

a. Carbohydrates
b. Proteins
c. Fats
d. Vitamins
e. Minerals
f. Water

3540-1007. Outline and balance rations for animals.

3540-1008. Outline various nutritional diseases of animals:

a. Causes
b. Species affected
c. Symptoms
d Treatments
e. Prevention

STANDARD 3540-11	**The students will investigate animal health disease prevention and parasite control (microbiology).**

OBJECTIVES

3540-1101. Determine signs of good health in livestock.

3540-1102. Identify common poisonous plants and the effect on animals.

3540-1103. Outline common diseases of animals:

a. Species affected
b. Causes
c. Symptoms
d. Treatment
e. Prevention

3540-1104. Demonstrate proper animal sanitation and government regulations on animal sanitation.

3540-1105. Identify common parasites of animals:

a. Parasite
b Effect on animal
c. Controls
d. Treatment

STANDARD 3540-12	**The students will explain the interaction between biotic and abiotic factors of an ecosystem.**

OBJECTIVES

3540-1201. Identify biotic factors in the system (food chain, diseases, and infestations).

3540-1202. Relate the following to a natural ecosystem:

a Habitat
b. Population
c. Biome
d. Succession
e. Community
f. Niche

3540-1203. Recognize ways that humans have changed the biotic and abiotic factors in the biosphere.

3540-1204. Evaluate an individual's role and responsibility to the ecosystem.

STANDARD 3540-13	**The students will explain the importance of entrepreneurship and strategy for marketing livestock.**

OBJECTIVES

3540-1301. Determine importance of marketing.

3540-1302. Determine geography of meat production and consumption.

3540-1303. Develop a marketing strategy for commodities.

STANDARD 3540-14	The students will demonstrate the proper location, construction, and spacing of livestock buildings and equipment.

OBJECTIVES

3540-1401. Illustrate proper location of farm and ranch headquarters.

3540-1402. Illustrate proper farmstead arrangement.

3540-1403. Determine requisites of livestock buildings; i.e., cost, durability, protection, spacing.

STANDARD 3540-15	The students will recognize the global perspective of a high quality and ample supply of food.

OBJECTIVES

3540-1501. Assess the world food situation with emphasis on shortage.

3540-1502. Assess the factors affecting the supply of food.

3540-1503. Assess the factors affecting the demand for food.

3540-1504. Develop a concept of how to improve the world food situation.

STANDARD 3540-16	The students will observe the natural balance between organisms and their environment.

OBJECTIVES

3540-1601. Recognize the importance of a balance of range lands and the stocking rates of livestock and wildlife (range analysis).

3540-1602. Evaluate the importance of government lands for recreation and range for livestock.

STANDARD 3540-17	The students will select and demonstrate three or more of the above standards in a job or work setting.

OBJECTIVES

3540-1701. Select a job setting or project (supervised occupational experience program) with emphasis on entrepreneurship.

3540-1702. Keep a current record of supervised occupational experience project.

3540-1703. Analyze and evaluate the results and make appropriate adjustments based on findings.

SCIENCE LEVEL 9-12

COURSE TITLE	UNIT OF CREDIT	PREREQUISITE
Plant and Soil Science and Technology	1*	Mastery of Science through Level 8

BIO-PLSCTECH

CIP 02.0401
SIS COURSE NUMBER: 3560
SIS CODE: SB/VO

COURSE DESCRIPTION

An instructional course that emphasizes a pragmatic approach to scientific principles i plant and soil science and technology utilizing available classroom, greenhouse, land-laboratories, and commercial operations to enhance learning.

NOTE: * **Successful completion of BOTH "Plant and Soil Science and Technology" and "Animal Science and Technology" is required to satisfy the core requirement in biological science. Two units will be granted, one in biological science and one in vocational education. A subject specific endorsement in biological science (7-12) is required for satisfaction of the science credit.**

CORE STANDARDS OF THE COURSE

STANDARD 3560-01	**The students will discover the relationship of the Future Farmers of America (F.F.A.) and Vocational Agriculture history.**

OBJECTIVES

3560-0101. Outline and determine the basic history of the F.F.A.

3560-0102. Become aware of the basic aims and purposes of the F.F.A.

3560-0103. Develop leadership qualities for personal goals.

STANDARD 3560-02	**The students will discover and investigate plant cell structure and function.**

OBJECTIVES

3560-0201. Summarize the function of each of the organelles within a plant cell.

3560-0202. Discuss the following processes relating to the cell:

a. Diffusion
b. Osmosis
c. Active transport

3560-0203. Explain cell division and describe the phases of mitosis.

3560-0204. Recognize that cells are the foundation of higher levels of organization; e.g., leaf, stem, roots.

STANDARD 3560-03	**The students will discover cell chemistry and cell energy.**

OBJECTIVES

3560-0301. Explain the nature and role of the following essential molecules in cells: carbohydrates, fats, proteins, nucleic acids, and enzymes.

3560-0302. Explain the role of ATP as the source of cell energy.

3560-0303. Differentiate between aerobic and anaerobic respiration.

3560-0304. Distinguish between autotrophs and heterotrophs.

STANDARD 3560-04	**The students will identify classifications in the plant kingdom.**

OBJECTIVES

3560-0401. Observe plant hierarchy and its relationship to classification and identification.

3560-0402. Explain and illustrate, with examples, the binominal system of scientific naming; i.e., crop and horticulture plants.

3560-0403. Classify and identify organisms using a dichotomous key.

3560-0404. Identify nonfood uses of plants; i.e., timber, fuel, pulp, fiber, and aesthetic uses.

STANDARD 3560-05	The students will cite evidence that living things progress from simple to complex organization in a variety of life.

OBJECTIVES

3560-0501. Describe and compare the characteristics which identify the protists, fungi, and monera.

3560-0502. Evaluate several beneficial and harmful effects of protists, fungi, and monera, as they relate to humans.

3560-0503. Describe and compare the characteristics of algae, bryophytes, and tracheophytes.

3560-0504. Discuss alternation of generation in plants as a reproductive method.

3560-0505. Contrast differences between monocots and dicots.

3560-0506. Evaluate several beneficial and harmful effects of plants as they relate to humans.

STANDARD 3560-06	The students will investigate plant reproduction and propagation.

OBJECTIVES

3560-0601. Identify and define steps in a common plant life cycle for sexual reproduction.

3560-0602. Identify and become proficient in asexual propagation concepts and methods.

3560-0603. Contrast sexual and asexual reproduction.

3560-0604. Diagram the concepts of meiosis and mitosis.

3560-0605. Illustrate and explain meiosis and its importance in sexual reproduction.

STANDARD 3560-07	The students will investigate the principles of genetics and their applications.

OBJECTIVES

3560-0701. Describe and discuss the four principles of the Mendelliam Theory:

a. Unit characteristics
b. Principle of segregation
c. Principle of independent assortment
d. Principle of dominance

3560-0702. Compare elements of the genetic code (R.N.A., D.N.A.).

3560-0703. Recognize and define haploid, diploid, homologous, somatic cells, recessive, etc.

STANDARD 3560-08	**The students will describe and analyze nutrient interactions in plants.**

OBJECTIVES

3560-0801. List the function of essential elements in plant nutrition (micro nutrients and macro nutrients).

3560-0802. Recognize and describe symptoms of plant nutrient deficiencies.

3560-0803. Be able to describe two specific types of nutrient deficiency tests (plant tissue and soil).

3560-0804. Identify nutrient cycles in an ecosystem and effects of moisture and temperature on food production.

STANDARD 3560-09	**The students will investigate plant cells and the basic processes of cellular energy conversion.**

OBJECTIVES

3560-0901. Describe the process of photosynthesis.

3560-0902. Describe the chemical responses that take place in the light and dark reaction of photosynthesis.

3560-0903. Interpret the relationship of photosynthesis with sunlight, temperature, water, and carbon dioxide.

3560-0904. Explain the process of respiration.

3560-0905. Interpret the relationship of respiration with oxygen and temperature.

3560-0906. Compare the flow of energy through photosynthesis and respiration.

STANDARD 3560-10	**The students will describe the relationship between plant growth and water.**

OBJECTIVES

3560-1001. Interpret the process of translocation and transpiration.

3560-1002. Describe the process of water uptake (osmosis, etc.).

3560-1003. Discuss and interpret the effects of temperature, humidity, and air flow on water use.

STANDARD 3560-1 1	**The students will describe and analyze variations in plant morphology and anatomy.**

OBJECTIVES

3560-1101. Identify and define common plant components:

a. Seed anatomy
b. Seed germination (morphology)
c. Leaf morphology and anatomy
d. Stem (modification, nodes, internodes, tissue morphology, apical and auxiliary buds)
e. Flowers (complete, incomplete, perfect, imperfect, and inflorescence)
f. Fruits (simple, aggregate, accessory, and multiple)
g. Roots (primary, secondary, root hairs, and growth habits)

STANDARD 3560-1 2	**The students will describe the relationship between plant growth and soil.**

OBJECTIVES

3560-1201. Differentiate between how plants grow (reproductive and vegetative).

3560-1202. Define and demonstrate plant growth hormones and regulators (auxins and gibberilins, cytokinins, ethylene, and abscisic acid).

3560-1203. Identify plant life cycles (annuals, biennials, and perennials).

3560-1204. Explain the process of bud and fruit development.

3560-1205. Identify the chemical properties of soil (pH and fertility).

3560-1206. Test soils and analyze results to make fertilizer recommendations for necessary nutrients.

3560-1207. Illustrate the movement of water in soil; i.e., gravitational, capillary, field capacity, hygroscopic, leaching.

STANDARD 3560-13	The students will identify and classify soil concerning formation use.

OBJECTIVES

3560-1301. Understand basic soil classifications.

3560-1302. Explain how soil properties effect plant growth.

3560-1303. Discuss how soils respond differently to management practices.

3560-1304. Explain the influence of land features on production and land protections.

3560-1305. Explain suitable soil and water conservation practices.

3560-1306. Determine land capability classes.

3560-1307. Determine proper use and treatment of the land resources.

STANDARD 3560-14	The students will describe and analyze plant diseases.

OBJECTIVES

3560-1401. Describe and compare the characteristics which identify fungi, bacteria viruses, and mycoplasmas.

3560-1402. Evaluate and compare beneficial and harmful bacteria, fungi viruses, and mycoplasmas.

3560-1403. Identify, analyze, and evaluate common plant diseases.

3560-1404. Consider the causes, spread, and control of common plant diseases (fungi, bacteria, and viruses).

STANDARD 3560-15	The students will identify and evaluate plant disorders.

OBJECTIVES

3560-1501. Develop a system for diagnosing plant disorders.

3560-1502. Identify symptoms of plant disorders created by imbalances of water, temperature, air, light, and nutrients.

3560-1503. Recognize plant disorders that are caused by environmental factors and physical damage and develop a disorder prevention management plan.

STANDARD 3560-16	The students will identify and classify plant pests (vertebrates, invertebrates, and weeds).

OBJECTIVES

3560-1601. Identify insect pests that are detrimental to specific plant groups.

3560-1602. Identify weed pests that are detrimental to specific plant groups.

3560-1603. Identify soil organisms that are detrimental to specific plant groups.

3560-1604. Identify vertebrates that are detrimental to specific plant groups.

3560-1605. Identify and describe proper procedures for integrated pest management systems:

a. Weeds
b. Insects
c. Soil organisms
d. Vertebrates

STANDARD 3560-17	The students will recognize that interactions between the living and non-living environments result in a dynamic balance.

OBJECTIVES

3560-1701. Observe firsthand a biotic community in a backyard, school ground, or neighborhood. List the living and nonliving parts, and show the interrelationships.

3560-1702. Organize the members of the biotic community you observed into a food web and identify the producers, consumers, and decomposers.

3560-1703. Identify an interaction between two organisms you studied in the observed community; e.g., mutalism, commensalism, parasitism, predation, scavenging, competition.

3560-1704. In the observed biotic community, describe where energy enters the living system, the direction of flow through it, and the overall loss of energy by each succeeding consumer level.

3560-1705. Diagram the cycles (water, carbon-oxygen, nitrogen, phosphate) present in the observed biotic community emphasizing interactions between both the living and nonliving parts.

3560-1706. Through experimentation or demonstration with light, temperature, water, soil, air, or topography, measure the physical interactions between any pair of these limiting factors; e.g., light versus temperature, light versus topography, water versus soil, water versus topography.

3560-1707. Interpret data relating to an organism's ability to tolerate gradients of limiting factors and relate this to the observed community.

3560-1708. Relate limiting factors to care and selection of plants and animals appropriate for home, agriculture, or space exploration.

3560-1709. Observing local ecosystems, determine the physical and topographic factors which cause the various communities.

3560-1710. Given a list of plants, animals, and climatic conditions, identify the world biome in which these are found.

3560-1711. Place in successional order a list of life forms and physical changes that are involved in establishment of a stable community for each of the following: lake, rock, sand dune, vacant lot, and burned forest.

STANDARD 3560-18	**The students will observe that a natural balance between organisms and their environment can be altered by natural or man-controlled events. Cite examples.**

OBJECTIVES

3560-1801. Observe and describe an individual ecosystem and the balance of nature therein.

3560-1802. Analyze and evaluate the effects of pollution, invasion, and alterations to an ecosystem.

3560-1803. Compare tillage systems and their effect on an ecosystem.

STANDARD 3560-19	**The students will recognize interaction between living and nonliving environments.**

OBJECTIVES

3560-1901. Discuss relationships in wildlife and domestic animals as they exist within the ecosystem.

3560-1902. Explain agricultural sampling techniques; i.e., Range Line Intersect Method.

3560-1903. Interpret wildlife habitat in relation to ecological environment.

3560-1904. Make predictions, decisions, and conclusions; i.e., range management --in terms of stocking rate, plant population, community competition, succession, and other management principles.

STANDARD 3560-20	The students will investigate the principle of population dynamics.

OBJECTIVES

3560-2001. Sample an area in an ecosystem and compare plants and animals concerning population dynamics. Describe the results.

3560-2002. Describe possible effects of changes in population related to environmental quality, technology, food production, soil and water, climate, over-grazing, and resource management.

3560-2003. Recognize the importance of a balance of range lands and the stocking rates of livestock and wildlife (range analysis).

3560-2004. Evaluate the importance of government lands for recreation and range for livestock.

STANDARD 3560-21	The students will select or demonstrate three or more of the above standards in a job or work setting.

OBJECTIVES

3560-2101. Select a job setting or project (supervised occupational experience program) with emphasis on entrepreneurship.

3560-2102. Keep a current record of a supervised occupational experience project.

3560-2103. Analyze and evaluate the results and make appropriate adjustments based on findings

SCIENCE LEVEL 9-12

COURSE TITLE	UNIT OF CREDIT	PREREQUISITE
Human Biology*	1**	Mastery of Science through Level 8

HUMAN BIOL

SIS COURSE NUMBER: 3580
SIS: SB

COURSE DESCRIPTION

The focus of this one unit course in the high school science core centers on biology with emphasis on the human organism. This course begins with a discussion of the physical basis of life and proceeds through levels of increasing complexity. In addition, this course emphasizes the following: complementary nature of structure and function, homeostasis, metabolic processes, pathological disorders, and evolution of body systems. This course lends itself to laboratory investigation and is relevant to student needs and interest.

NOTE: **** A subject specific endorsement in biological science (7-12) is required for satisfaction of the biological science credit.**

CORE STANDARDS OF THE COURSE

STANDARD 3580-01	**The students will demonstrate proper laboratory skills.**

OBJECTIVES

3580-0101. Demonstrate the safe use of biological equipment and selected chemicals.

3580-0102. Properly use a microscope and other biological equipment and materials.

STANDARD 3580-02	**The students will discover that cells are composed of essential substances which participate in a number of biochemical pathways which are common to all organisms. (CELL CHEMISTRY AND ENERGY)**

OBJECTIVES

3580-0201. Distinguish between the following terms: element, molecule, and compounds.

*NOTE: See attached Appendix

3580-0202. Explain the nature and role of the following essential molecules in cells: carbohydrates, fats, proteins, nucleic acids, and enzymes.

3580-0203. Define ATP and explain its role as a source of cell energy.

3580-0204. Describe the flow of energy through the processes of cellular respiration (anaerobic and aerobic).

STANDARD 3580-03	**The students will recognize that humans have basic structural and functional properties at the cellular, tissue, and organ levels. (CELL STRUCTURE AND FUNCTION)**

OBJECTIVES

3580-0301. Summarize the function of each of the organelles within the human cells.

3580-0302. Discuss the following processes relating to the cell:

a. Passive transport
b. Active transport

3580-0303. Explain the cell cycle and describe the phases of mitosis and cytokinesis.

3580-0304. Recognize that cells are the foundation of higher levels of organization; e.g., tissues, organs, systems.

3580-0305. Describe the structure and function of the following major kinds of tissues:

a. Epithelial
b. Connective
c. Muscle
d. Nerve

3580-0306. Define the concept of homeostasis and recognize that it has an important application to the function of all organ systems.

STANDARD 3580-04	**The students will investigate body coverings, support, and movement systems of the human body. (INTEGUMENTARY, SKELETAL, AND MUSCULAR SYSTEMS)**

OBJECTIVES

3580-0401. Describe the structure and function of the integumentary system in terms of:

a. Layers of skin.
b. Accessory organs of skin.
c. Disorders and diseases associated with the skin.

3580-0402. Describe the structure and function of the skeletal system in terms of:

a. The evolutionary development from simple life forms up to the human form.
b. Development, growth, and repair of bones.
c. Articulations and accessory structures.
d. Disorders and diseases associated with the skeleton.

3580-0403. Describe the structure and function of the muscular system in terms of:

a. Types and characteristics of muscles.
b. Contraction of a muscle.
c. Effects of exercise.
d. Disorders and diseases associated with the muscular system.

STANDARD 3580-05	**The students will investigate the structure and function of the control systems of the human body. (NERVOUS AND ENDOCRINE SYSTEMS)**

OBJECTIVES

3580-0501. Trace the evolution of nervous systems from simple life forms up to the human form.

3580-0502. Describe the structure and function of a neuron.

3580-0503. Describe the structure and function of the divisions of the nervous system as it relates to:

a. Central nervous system.
b. Peripheral nervous system.

3580-0504. Describe the location, structure, and function of each type of sensory organ.

3580-0505. Explain a nerve impulse and pathways associated with the transmission of that impulse.

3580-0506. Describe disorders and diseases of the nervous system.

3580-0507. Name and locate the major endocrine glands and identify the hormones they secrete.

3580-0508. Describe the functions of the major hormones.

3580-0509. Describe the effects of hypo- and hyper-secretions of the major hormones.

STANDARD 3580-06	**The students will investigate the processes of digestion, nutrition, and metabolism. (DIGESTIVE SYSTEM)**

OBJECTIVES

3580-0601. Trace the evolution of the digestive systems from simple life forms up to the human form.

3580-0602. Locate, name, and give the function of the organs of the digestive system with their associated structures.

3580-0603. Explain the metabolism of carbohydrates, fats, and proteins and discuss the importance of a balance of each to proper nutrition.

3580-0604. Relate the importance of vitamins, minerals, and water to adequate nutrition.

3580-0605. Define metabolic rate and list factors that affect it.

3580-0606. Describe the diseases and disorders of the digestive system.

STANDARD 3580-07	**The students will investigate systems of internal transport and defense mechanisms. (CARDIOVASCULAR, LYMPHATIC, IMMUNE, RESPIRATORY, URINARY SYSTEMS)**

OBJECTIVES

3580-0701. Trace the evolution of the circulatory systems from simple life forms up to the human form.

3580-0702. Describe the structure and function of the heart and vessels and trace the circulation of blood through the body.

580-0703. Explain the principal events of the cardiac cycle including conduction, stroke volume, and cardiac output. Correlate these with EKG, blood pressure, and pulse.

3580-0704. Analyze the composition of blood; i.e, blood types, cells, plasma, pH, volume.

3580-0705. Investigate diseases and disorders of the circulatory system.

3580-0706. Describe the components of the lymphatic system and list their functions.

3580-0707. List and explain the function of the cells of the immune system; i.e., B-cells, T-cells, phagocytes.

3580-0708. Distinguish between antigens and antibodies and explain antibody selection, production, and action in response to antigens.

3580-0709. Compare and contrast active and passive immunity.

3580-0710. Discuss diseases and disorders of the immune system.

3580-0711. Trace the evolution of the respiratory systems from simple life forms up to the human form.

3580-0712. Identify the structures of the respiratory system and explain their functions.

3580-0713. Explain how oxygen and carbon dioxide are exchanged at the surface of the lung, transported in the blood, and exchanged in the tissues.

3580-0714. Name and define each of the respiratory air volumes.

3580-0715. Discuss how various factors affect the respiratory center.

3580-0716. Discuss the diseases and disorders of the respiratory system; i.e., harmful effects of tobacco, pollutants.

3580-0717. Trace the evolution of the urinary systems from simple life forms up to the human form.

3580-0718. Name the organs of the urinary system and list their functions.

3580-0719. Define the structural adaptations of the nephron for urine formation.

3580-0720. Discuss the process of urine formation through glomerular filtration, tubular reabsorption, and tubular secretion.

3580-0721. Explain the contribution of the kidney to acid base, electrolyte, and water balance.

3580-0722. Investigate the diseases and disorders of the urinary system.

STANDARD 3580-08*	The students will investigate the human life cycle. (REPRODUCTIVE SYSTEM, DEVELOPMENT, AND CHILD BIRTH)

[Teachers must be aware that state law requires prior written parental consent before including any aspect of contraception in the curriculum.]

OBJECTIVES

3580-0801. Trace the evolution of the reproductive systems from simple life forms up to the human form.

3580-0802. Discuss the structure and function of the male and female reproductive organs.

3580-0803. Outline the process of meiosis and explain why the resulting sex cells contain different combinations of genetic information (spermatogenesis and oogenesis).

3580-0804. Describe the principal events of the menstrual cycle, correlating pituitary, hypothalamic, ovarian, and uterine responses and interactions.

3580-0805. Explain how hormones control activities of the reproductive organs and how they are related to the development of secondary sexual characteristics.

3580-0806. Explore human pregnancy and development; i.e., fertilization, implantation, embryonic and fetal development, child birth.

3580-0807. Discuss the stages of development that occur between birth and death and list the general characteristics of each stage.

3580-0808. Describe disorders and diseases of the reproductive system.

STANDARD 3580-09	The students will explain the passage of heredity information by genetic code. (HEREDITY)

OBJECTIVES

3580-0901. Describe the structural framework and replication of DNA and recognize its role as the basis of the genetic code.

3580-0902. Discuss the role of nucleic acids in protein synthesis

*NOTE: See attached Appendix

3580-0903. Explain Mendelian heredity and relate it to chromosomes, genes, mutations, and gametes.

3580-0904. Identify the genetic basis for sex determination.

3580-0905. Analyze human genetic problems utilizing probability and pedigree charts.

3580-0906. Identify gene disorders; i.e., cystic fibrosis, Huntington's disease, hemophilia, sickle-cell anemia, Tay-Sachs.

3580-0907. Identify from the chromosome makeup (karyotype), the following chromosomal abnormality syndromes and describe their characteristics: Down's syndrome, Turner's syndrome, Kleinfelter's syndrome, XXY, XXX.

STANDARD 3580-10	**The students will describe and interpret current theories of human origins and taxonomy. (EVOLUTION AND TAXONOMY)**

OBJECTIVES

3580-1001. Compare the characteristics of humans with primates.

3580-1002. Trace the theory of human history; i.e., A afarensis, A africanus, Homo erectus, Neanderthal.

3580-1003. Identify how natural selection acts as the vehicle of human evolution.

STANDARD 3580-11	**The students will observe that a natural balance between organisms exists and that this balance can be altered by human controlled events.**

OBJECTIVES

3580-1101. Describe the ecosystem that supports and sustains human life.

3580-1102. Recognize ways that humans have changed the abiotic and biotic factors in the biosphere; i.e., pollution, populations, habitat alterations.

3580-1103. Evaluate an individual's place in and responsibility to the ecosystem.

STANDARD 3580-12	**The students will select three objectives from this course and apply each of these objectives in a job or work setting.**

OBJECTIVES

3580-1201. Describe how each of three selected **OBJECTIVES** is applied or used in a job or work setting.

3580-1202. Select a job or work setting and show how the science concepts of this course has changed the manner in which work has been done in that job or setting.

3580-1203. Solve a problem applied to a job or work setting for each of three **OBJECTIVES** from this course.

APPENDIX

Caution should be used by teachers in discussing the reproductive system, including such items as sexually-transmitted diseases, intercourse, morality, AIDS, etc. The curriculum should present factual, straightforward information for students. The State Board of Education has adopted the following guidelines on what may **not** be taught:

1. The intricacies of intercourse, sexual stimulation, erotic behavior, etc.

2. The acceptance of or advocacy of homosexuality as a desirable or acceptable sexual adjustment or lifestyle.

3. The advocacy or encouragement of contraceptive methods or devices by unmarried minors.

4. The acceptance of or advocacy of "free sex," promiscuity, or so-called "new morality."

Teachers must be aware that state law requires prior written parental consent before including any aspect of contraception in the curriculum.

On occasion, an educator may be faced with spontaneous comments or questions from students about matters which are normally subject to parental request requirements under this policy. In some cases, failure to respond to such a comment or question could lead students to believe that the educator tacitly agrees with the views expressed, thereby lending the educator's unwilling support to what could well be an erroneous or dangerous practice or belief. In order to avoid such outcomes, an educator may respond to a student's comment or question regarding contraceptive devices or substances, even though a parental permission slip is not on file.

An educator may not intentionally elicit comments or questions about matters subject to parental consent requirements under this policy. Responses permitted under this section must be brief, factual, objective, and in harmony with content requirements of this policy regarding the importance of marriage and the family, abstinence from sexual activity before marriage, and fidelity after marriage. Responses must be appropriate to the age and maturity of the students involved, and limited in scope to that reasonably necessary under the circumstances. Students shall then be referred to their parents for further information. A response made in compliance with the requirements of this section shall not be considered to be a violation of the parental consent requirements of this policy.

The teaching of morality in the public schools is mandated under state law. Instruction about human sexuality must promote:

> 53A-13-101(4): Honesty, temperance, morality, courtesy, obedience to law, respect for and an understanding of the Constitutions of the United States and the state of Utah, the essentials and benefits of the free enterprise system, respect for parents and home, and the dignity and necessity of honest labor and other skills, habits, and qualities of character which will promote an upright and desirable citizenry and better prepare students for a richer, happier life shall be taught in connection with regular school work.
>
> "Because the law mandates the teaching of morality, . . . and mandates the obedience to law[s] . . . prohibiting such things as lewdness, sodomy, obscenity, and contributing to the delinquency of minors; and mandates teaching which will prepare youth for a richer, happier life, it is my opinion, that it is clearly appropriate that the public schools teach chastity to their students. Certainly nothing should be done or condoned by teachers or administrators which would teach, promote, or condone immorality or unchastity." (Robert B. Hansen, Attorney General, November, 1978)

Teachers should be aware of any district policies related to human reproduction, AIDS, and sex education and incorporate these policies in their instruction.

The State Board of Education publication, **Responsible Healthy Lifestyles: Teacher Resource File For AIDS Education, 1988,** should be used in AIDS instruction.

SCIENCE LEVEL 9-12

COURSE TITLE	UNIT OF CREDIT	PREREQUISITE
Physical-Earth Science (Core Option)	1.0	Mastery of Science through Level 8

PHYS-EARTH

SIS COURSE NUMBER: 3600
SIS CODE: SP

COURSE DESCRIPTION

This nontraditional course focuses on the practical applications of physical and earth science rather than only theoretical aspects. The primary focus of the course investigates the interrelationships between science principles, technological innovations, and societal impact (STS). It is intended that current readings will form the basis of the instructional material with texts to supplement background concepts.

Instructional emphasis should be directed toward the following skills: observing, measuring, inferring, classifying, predicting, establishing relationships, communication, problem solving, and decision making within the framework of each of the standards. Evaluation should be based upon these skills.

Each standard has objectives based on the following format: The first objective(s) directs the students' attention to the use of the specific standard in their lives. The next objective(s) gives the students hands-on experiences to review or develop concepts relevant to the standard. The next objective(s) considers the effects and extends these concepts into related aspects of their lives. The last objective(s) provides decision-making opportunities on societal issues. Topics and activities are suggested to provide direction, not to limit teacher creativity or flexibility.

CORE STANDARDS OF THE COURSE

STANDARD 3600-01	**The students will investigate chemically produced products and new materials.**

OBJECTIVES

3600-0101. Describe products and new materials and how they are produced by chemical technology for use in the home, agriculture, medicine, and industry.
Possible topics: fabrics, petroleum products, plastics, alloys, fertilizers, resources used.

3600-0102. Prepare several materials and investigate their properties and the processes involved in their production.
Possible materials: acids, bases, soaps, fibers, extract metal from ore, flavors.
Possible background topics: atomic structure, periodic relationships, bonding, chemical reactions.

3600-0103. Consider effects of chemical technology on the environment and society.

Possible topics: natural resources, quality of life, acid rain, employment, pollution.

3600-0104. Analyze and evaluate a current issue(s) related to chemical technology.
Possible topics: chemical plant location, health effects, chemical warfare, nuclear plants, toxic waste.

STANDARD 3600-02	**The students will investigate the principles and issues related to energy.**

OBJECTIVES

3600-0201. Examine the forms of energy you use and their conversions.

3600-0202. Experiment with energy conversions.
Possible topics: chemical/electricity, chemical/heat, heat/electricity, potential/kinetic energy, solar/heat, solar/electric, storage batteries, thermal mass.

3600-0203. Calculate and compare energy use and costs of everyday activities.
Possible topics: calories, B.T.U., therms, watts, appliance efficiency, utility bills, conservation, caloric intake and use, heat, temperature.

3600-0204. Consider the effects of energy production and use on society and the environment.
Possible topics: alternate sources, standard of living, pollution, economics, employment.

3600-0205. Evaluate energy-related issues.
Possible topics: resource depletion, dependence, nuclear energy, plant location.

STANDARD 3600-03	The students will investigate scientific principles and issues related to transportation.

OBJECTIVES

3600-0301. Examine criteria for selecting or developing a mode of transportation.
Possible topics: cost, acceleration, maximum velocity, safety, reliability, size, efficiency.

3600-0302. Experiment with the physical principles used in simple machines and transportation.
Possible topics: velocity acceleration, machines, mechanical advantage, friction, efficiency, power.

3600-0303. Consider the effects of machines and transportation on society and the environment.
Possible topics: automation, robotics, mobility, product availability, accidents, pollution, resource depletion, future trends.

3600-0304. Defend a position on an issue related to transportation.
Possible topics: mass transit, speed limits, fuels, pollution, airport placement, resource depletion, future trends, mandatory seat belts, efficiency versus safety.

STANDARD 3600-04	The students will investigate principles and issues related to communication.

OBJECTIVES

3600-0401. Describe the ways that communication technology is used in our lives.
Possible topics: telephone, television, radio, computers, global communication, information access and processing, entertainment.

3600-0402. Experiment with several physical principles used in communication.
Possible topics: wave properties, sound, electromagnetic spectrum (radio, infrared, visible, x-ray, color), fiber optics, lasers.

3600-0403. Consider the effects of new communication methods on society.
Possible topics: availability, cost, databases, fiber optics, employment, satellites, dependence, national security, computers, copy machines, video machines.

3600-0404. Defend a position on a communication-related issue.
Possible topics: right-of-access, computer fraud, satellite dish regulation, cable TV, propaganda.

STANDARD 3600-05	**The students will explore chemical and physical principles and technology related to the earth's crust.**

OBJECTIVES

3600-0501. Examine the changes taking place in your local landscape because of human activity.
Possible topics: loss of slope stability, watershed deterioration, flooding, soil erosion.

3600-0502. Identify and describe the local features produced by rapid or slow geological change.
Possible topics: valleys, landslides, flood deposits, soils, mudflows, creeps.

3600-0503. Use geological maps and/or other observation methods to locate building sites, hazards, energy and mineral resources, transportation routes, and earthquake features.

3600-0504. Collect some materials produced from minerals and identify their sources, compositions, and applications.
Possible materials: ceramics, brick, metals, cement, glass, borax products, gypsum.

3600-0505. Evaluate the impact of the use of energy, mineral, and water resources on the individual, society, and the environment.
Possible topics: fuel shortages and production costs, employment, pollution, water shortages and excesses.

STANDARD 3600-06	**The students will understand physical and geological processes taking place in the hydrosphere.**

OBJECTIVES

3600-0601. Trace the possible history of a glass of water.
Possible topics: water cycle, water purification, recycling, groundwater, water budget, waste treatment, phase changes.

3600-0602. Experiment with some of the unique properties of water.
Possible topics: solvency, surface tension, specific heat, density changes with temperature and salinity, heats of vaporization, fusion, polarity, specific gravity.

3600-0603. Consider the aspects of ocean dynamics that have an effect on the water supply of Utah.
Possible topics: ocean currents, ocean temperatures, heat sink, el nino effect.

3600-0604. Suggest directions for extending water resources for growing populations.
Possible topics: desalination of seawater, polar ice, conservation.

3600-0605. Defend a position on water uses.
Possible issues: Central Utah Project, salinity changes, depletion of aquifers, subsidence, soil quality, water shortages, recreational use, energy, industrial use.

STANDARD 3600-07	**The students will investigate chemical and physical properties and processes of the earth's atmosphere.**

OBJECTIVES

3600-0701. Describe the impacts of weather on life activities.
Possible concerns: recreation, agriculture, economics.

3600-0702. Make and calibrate weather instruments and investigate the atmospheric principles involved.
Possible instruments: barometer, anemometer, thermometer, hygrometer, psychrometer, rain gauge, wind vane.
Possible topics: pressure, gas laws, vapor pressure, thermal expansion, humidity, dew point, wind chill, heat transfer.

STANDARD 3600-08	**The students will investigate the physics of the earth's space environment and its influence on man.**

OBJECTIVES

3600-0801. Explore impacts of space technology on our daily lives.
Possible topics: miniaturization, electronics, communications, waste disposal, medical benefits, remote sensing, new materials, employment.

3600-0802. Experiment with principles of orbiting bodies.
Possible topics: circular motion, gravity, Kepler's laws, Newton's laws, conservation of momentum, escape velocity, geosynchronous orbits.

3600-0803. Research and develop a project applying the concepts of space exploration, orbital motion, and free fall.
Possible subjects: design a space station, space mine, moon or planet station; duplicate or design a space shuttle experiment; plan a space vacation; plan a business use of space (orbiting solar energy system, hospital, manufacturing plant, resort).

3600-0804. Research and defend possible trends or alternatives on such a position on a current space-related issue.
Possible topics: military satellites, star wars, economics of space exploration, pollution of space.

STANDARD 3600-09	**The students will select three objectives from this course and apply each of these objectives in a job or work setting.**

OBJECTIVES

3600-0901. Describe how each of three selected objectives is applied or used in a job or work setting.

3600-0902. Select a job or work setting and show how the science concepts of this course has changed the manner in which work has been done in that job or setting.

3600-0903. Solve a problem applied to a job or work setting for each of three objectives from this course.

SCIENCE LEVEL 9-12

COURSE TITLE	UNIT OF CREDIT	PREREQUISITE
Chemistry (Core Option)	1.0	Elementary Algebra and mastery of science through Level 8

CHEMISTRY

SIS COURSE NUMBER: 3620
SIS CODE: SP

COURSE DESCRIPTION

The one unit chemistry core in the high school course includes a study of the behavior of matter, atomic structure, chemical and physical properties, chemical bonding, use of the periodic table, chemical equations and reactions, solutions, and the basic structure of organic compounds. Student laboratory investigations should be emphasized with safety being stressed. Emphasis is also placed on solving stoichiometric problems.

CORE STANDARDS OF THE COURSE

STANDARD 3620-01	**The students will demonstrate the ability to use correct laboratory practices and solve quantitative problems.**

OBJECTIVES

3620-0101. Demonstrate the proper use of laboratory and safety equipment.

3620-0102. Demonstrate the proper handling of chemical materials.

3620-0103. Solve quantitative problems applying the rules of significant figures.

3620-0104. Demonstrate a knowledge of scientific notation, metric conversions, and dimensional analysis (factor labor/unit analysis).

3620-0105. Demonstrate correct procedures for collecting, analyzing, and interpreting data.

STANDARD 3620-02	**The students will use the periodic table to determine the structure of atoms and to interpret and predict chemical and physical properties of elements.**

OBJECTIVES

3620-0201. Predict trends and patterns of atomic size, reactivity within a family, ionization energy, electronegativity, and metallic properties based on the periodicity of the elements.

3620-0202. Demonstrate a knowledge of the relationship between an element electron configuration and its valence/combining ability and use this relationship to predict chemical formulas and properties.

3620-0203. Identify major chemical and physical properties of alkali metals, alkaline earth metals, halogens, and noble gases.

3620-0204. Define the term isotope and describe its relationship to atomic weight.

3620-0205. Given the mass of an isotope and the periodic table, determine the number of protons, neutrons, and electrons.

3620-0206. Using the periodic table, determine the electron configuration for a given element.

STANDARD 3620-03	**The students will model, write, balance, and describe chemical equations and solve related stoichiometric problems.**

OBJECTIVES

3620-0301. Given a list of common ions, write formulas for chemical compounds.

3620-0302. Given the formulas for the reactants and products, balance a chemical equation using conservation of atoms and charge as the criteria.

3620-0303. From a list of reactions, identify the following: products, reactants, synthesis reactions, decomposition reactions, replacement/displacement reactions, and double replacement/displacement reactions.

3620-0304. Solve problems involving mass-mole conversions.

3620-0305. Using a balanced equation, apply Avogadro's principle and the mole concept in solving problems dealing with mass-mass, mass-volume, and volume-volume relationships.

3620-0306. Calculate the percentage composition of a compound.

3620-0307. Apply the law of definite composition in determining empirical formulas for chemical compounds.

3620-0308. Write an equation for an endothermic or exothermic chemical reaction including the heat of reaction.

STANDARD 3620-04	The students will interpret chemical bonding using appropriate models and notation.

OBJECTIVES

3620-0401. Define ionic bonding and covalent bonding.

3620-0402. Given a table and the periodic chart, use the concept of electronegativity to predict the kind of bonding that will occur between atoms of different elements; e.g., ionic, covalent, polar-covalent.

3620-0403. Compare the characteristics and properties such as melting point, boiling point, brittleness, and conductivity of ionic versus covalent bonded substances.

3620-0404. Use electron-dot symbols to illustrate ionic and covalent bonding between elements.

STANDARD 3620-05	The students will explain the behavior of matter in each of its three phases.

OBJECTIVES

3620-0501. Use the concept of molecular kinetic energy to explain observations associated with phase change.

3620-0502. Identify and explain the parts of the phase change graph (temperature vs. energy) and describe the changes in heat content and temperature associated with the various parts of the graph.

3620-0503. Compare and contrast solids, liquids, and gases with respect to fluidity, density, compressibility, and diffusion.

3620-0504. Use Charles' Law, Boyle's Law, and/or the ideal gas law to describe the relationships among pressure, temperature, and volume on a gaseous system and solve related problems.

STANDARD 3620-06	The students will explain aqueous solution phenomena.

OBJECTIVES

3620-0601. Recognize that solids, liquids, and gases may be solvents and/or solutes in solution.

3620-0602. Given appropriate information, determine the molarity and molality of a solution.

3620-0603. Explain the effect of temperature and pressure on solubility.

3620-0604. Explain freezing-point depression and boiling-point elevation in terms of solution concentration.

3620-0605. From a list of rules for solubility, predict the solubility of a substance in water.

3620-0606. Describe the relationship between the electrical conductance and the dissociation or ionization of an aqueous solution.

3620-0607. Explain the process of dynamic equilibrium in reversible aqueous reactions.

STANDARD 3620-07	**The students will identify and explain the nature and behavior of acids and bases.**

OBJECTIVES

3620-0701. Define acids and bases in terms of chemical and physical properties, proton transfer and the kinds of ions produced in solutions.

3620-0702. Determine pH and compare the acidity and basicity of different solutions.

3620-0703. Calculate the amount of concentrated acid or base needed to produce a given quantity of solution with a specified concentration.

3620-0704. Write balanced chemical equations to describe the reactions of acids with carbonates, hydroxides, and metals.

3620-0705. Apply appropriate rules for naming common acids and bases.

STANDARD 3620-08	**The students will investigate the nature of oxidation reduction (redox) reactions.**

OBJECTIVES

3620-0801. Define oxidation and reduction in terms of electron transfer.

3620-0802. Identify oxidizing agents and reducing agents.

3620-0803. Given an equation for a redox reaction, identify the oxidation and reduction half reactions.

3620-0804. Balance equations for redox reactions; e.g., oxidation-number or electron-transfer method, ion-electron or half-reaction method.

STANDARD 3620-09	**The students will describe the basic characteristic of organic compounds.**

OBJECTIVES

3620-0901. Explain the basic composition of organic compounds.

3620-0902. Recognize common examples of different organic compounds.

3620-0903. Illustrate the concept of structural isomerism.

3620-0904. Recognize the general structural differences of simple organic compounds; e.g., alcohol, aldehydes, ketones, ethers, carboxylic acids, esters, hydrocarbons.

STANDARD 3620-10	**The students will select three objectives from this course and apply each of these objectives in a job or work setting.**

OBJECTIVES

3620-1001. Describe how each of three selected objectives is applied or used in a job or work setting.

3620-1002. Select a job or work setting and show how the science concepts of this course has changed the manner in which work has been done in that job or setting.

3620-1003. Solve a problem applied to a job or work setting for each of three objectives from this course.

SCIENCE LEVEL 9-12

COURSE TITLE	UNIT OF CREDIT	PREREQUISITE
Physics (Core Option)	1	Elementary Algebra and mastery of Science through Level 8

PHYSICS

SIS COURSE NUMBERS: 3640
SIS CODE: SP

COURSE DESCRIPTION

In the one unit physics core in the high school, students will investigate the following content areas: mechanics, heat and thermodynamics, waves (with emphasis on light and sound), electricity, magnetism, and modern physics. The acquisition of problem solving skills, basic concepts of physics, and the fundamental principles of physics are stressed. A strong laboratory component requiring skill attainment in data gathering, the quantitative analysis of the data collected, and the interpretation of the results produced is central to this course. Career opportunities related to physics are examined.

CORE STANDARDS OF THE COURSE

STANDARD 3640-01	**The students will collect and analyze data; construct and interpret graphs; and use significant figures, scientific notation, order of magnitude, unit analysis, and appropriate mathematical functions.**

OBJECTIVES

3640-0101. Correctly use the available instruments in the laboratory to measure physical quantities (collect data).

3640-0102. Organize collected and/or computed data into charts and tables.

3640-0103. Manipulate numbers using scientific notation.

3640-0104. Use unit analysis (factor label/dimensional analysis) in solving problems.

3640-0105. Correctly apply the rules for handling significant figures.

STANDARD 3640-02	**The students will solve problems in kinematics.**

OBJECTIVES

3640-0201. Define position, displacement, average and instantaneous velocity, average and instantaneous speed, acceleration, scalar, and vector.

3640-0202. Distinguish between vector and scalar quantities and be able to state the value of a vector in terms of its magnitude and direction.

3640-0203. Find the resultant of two vectors graphically and trigonometrically, and resolve a vector into perpendicular components.

3640-0204. Use vector methods (see No. 3 above) to find the displacement from stated positions or resultant velocity in velocity addition situations.

3640-0205. Solve problems involving motion in a single direction with constant acceleration. Systems with zero acceleration are included in this category.

3640-0206. Solve problems involving uniform circular motion.

STANDARD 3640-03	**The students will examine the relationship among mass, force, and acceleration as contained in Newton's Laws of Motion; and will examine the concepts of momentum and the principle of the conservation of momentum.**

OBJECTIVES

3640-0301. Interpret the behavior of mechanical systems from the point of view of the relationship among force, mass, and acceleration contained in Newton's Laws of Motion.

3640-0302. State Newton's three laws of motion.

3640-0303. Find the vector sum of the application of two or more forces to a system.

3640-0304. Use Newton's Laws, especially the second law, to solve mechanics problems.

3640-0305. Use Newton's Laws, especially the second, to solve problems involving static and kinetic friction.

3640-0306. Solve problems involving the gravitational force.

3640-0307. Define the term momentum.

3640-0308. Determine the momentum of a moving mass.

3640-0309. Solve problems involving the principle of the conservation of momentum.

STANDARD 3640-04	**The students will describe the relationships among work, energy, and power and solve related problems.**

OBJECTIVES

3640-0401. Define work, power, and energy and distinguish between the "everyday" conception of work from its scientific meaning.

3640-0402. Describe both qualitatively and quantitatively the connection between work and energy.

3640-0403. Determine the gravitational potential energy of an object near the earth's surface.

3640-0404. Compute the kinetic energy of a moving mass.

3640-0405. Compute the work done on an object by any constant force applied to it.

3640-0406. Solve problems involving the principle of energy: both the conservation of energy and the conservation of momentum.

3640-0407. Compute the power developed or dissipated by a mechanical system from the work done and the time elapsed during which the work was done.

STANDARD 3640-05	**The students will examine the concepts of heat and temperature both macroscopically and microscopically; describe the first and second laws of thermodynamics; and investigate mechanisms of energy transfer.**

OBJECTIVES

3640-0501. Define and describe heat and temperature both macroscopically and microscopically from the kinetic-molecular viewpoint.

3640-0502. Solve heat flow problems involving temperature differences and/or phase changes.

3640-0503. State the first law of thermodynamics and use it in processes involving heat transfer (as in No. 2) and heat production.

3640-0504. State the second law of thermodynamics and apply it to heat transfer processes, heat engines and refrigerators, and the conversion of heat into work.

3640-0505. Describe heat transfer in terms of radiation, conduction, and convection.

STANDARD 3640-06	**The students will examine waves and describe wave phenomena.**

OBJECTIVES

3640-0601. Describe the relationships among frequency, period, wavelength, amplitude, and velocity of waves and solve related problems.

3640-0602. Describe the production of sound waves.

3640-0603. Define the terms: quality, harmonics, overtones, fundamental, amplitude, pitch, and resonance of sound waves.

3640-0604. Differentiate between transverse and longitudinal waves.

3640-0605. Describe the following in terms of wave phenomena:

a. Reflection
b. Refraction
c. Diffraction
d. Interference
e. Doppler effect
f. Standing wave
g. Polarization

STANDARD 3640-07	**The students will investigate the nature of light.**

OBJECTIVES

3640-0701. Identify the particle characteristics of light.

3640-0702. Identify the wave characteristics of light.

3640-0703. Solve problems using the law of reflection.

3640-0704. Solve problems involving the passage of light between two different media.

3640-0705. Construct ray diagrams of various types of lenses and mirrors predicting the nature of the images formed.

3640-0706. Explain the dispersion of light by a prism, using the relationship to color, frequency, and refractive index.

3640-0707. Identify the main segments of the electromagnetic spectrum (visible light, radio, micro, infrared, gamma, ultraviolet, x-ray, and cosmic).

3640-0708. List one major application of each segment of the electromagnetic spectrum.

3640-0709. Given two regions of the electromagnetic spectrum, determine the one with the higher energy.

3640-0710. Solve problems involving frequency, wavelength, and energy.

STANDARD 3640-08	**The students will examine the basic phenomena of electricity and magnetism; investigate the basic relationships describing charges at rest and in motion; and solve problems involving charges at rest, electric circuit problems, and problems dealing with magnetic fields.**

OBJECTIVES

3640-0801. Describe methods of charging objects.

3640-0802. Describe the characteristics of positive and negative charged objects.

3640-0803. State Coulomb's law and solve related problems.

3640-0804. Describe the electric field.

3640-0805. Define electric potential difference between points in space in terms of work done and charge.

3640-0806. Solve problems involving potential difference, charge, work, and energy.

3640-0807. Describe current flow.

3640-0808. Solve DC circuit problems using Ohm's law.

3640-0809. Describe the magnetic field.

STANDARD 3640-09	**The students will investigate and discuss radio activity, its effects, and uses.**

OBJECTIVES

3640-0901. Describe the three principal types of radioactivity (alpha particles, beta particles, and gamma rays).

3640-0902. Distinguish between natural and artificial radioactivity and give an example of each.

3640-0903. Compare and contrast fission and fusion.

3640-0904. Explain where the energy comes from in fission and fusion reactions.

3640-0905. Define half-life and recognize the typical curve associated with it.

3640-0906. Discuss some pros and cons of using nuclear energy.

STANDARD 3640-10	**The students will select three objectives from this course and apply each of these objectives in a job or work setting.**

OBJECTIVES

3640-1001. Describe how each of three selected objectives is applied or used in a job or work setting.

3640-1002. Select a job or work setting and show how the science concepts of this course have changed the manner in which work has been done in that job or setting.

3640-1003. Solve a problem applied to a job or work setting for each of three objectives from this course.

SCIENCE LEVEL 9-12

COURSE TITLE	UNIT OF CREDIT	PREREQUISITE
Principles of Technology I (Core Option)*	1	Algebra and mastery of Science through Level 8

PRIN-TECH I

CIP 21.0600
SIS COURSE NUMBER: 3660
SIS CODE: SP/VO

COURSE DESCRIPTION

An instructional course in applied physical science that teaches technical principles, concepts, science, and mathematical skills through hands-on laboratory experiences. The course includes the study of mechanical, fluid, thermal, and electrical systems. These systems are taught by focusing on the concepts of force, work, rate, resistance, energy, power, and force transformers.

This Unified Technical Concepts approach uses methods including discovery, inquiry, and problem solving to teach technological applications of scientific principles. Any student who will use technology in their chosen career option should take this prerequisite class, followed by Principles of Technology II, before graduation from high school.

***A subject specific endorsement in either physics or physical science (7-12) is required for physical science credit. A vocational education endorsement is required for satisfaction of the vocational education core requirement.**

CORE STANDARDS OF THE COURSE

STANDARD 3660-01	**The students will collect and analyze data; construct and interpret graphs; use scientific notation, unit analysis using both the SI and English systems, and appropriate mathematical functions.**

OBJECTIVES

3660-0101. Correctly use the available instruments in the laboratory to measure physical quantities and rates (collect data).

3660-0102. Organize collected and/or computed data into charts, graphs, and tables.

3660-0103. Manipulate numbers using scientific notation.

3660-0104. Use unit analysis (factor label/dimensional analysis) in solving problems.

STANDARD 3660-02	The students will examine force, describe force concepts, and solve related force problems.

OBJECTIVES

3660-0201. Analyze the mechanical aspects of force including vectors, stress, and torque.

3660-0202. Determine the fluid aspects of force, including pressure, specific gravity, and density.

3660-0203. Explore the electrical aspects of force including voltage measurements, circuit analysis, and electrical sources.

3660-0204. Investigate the thermal aspects of force including systems of measure, transfer characteristics, and thermocouple junctions.

3660-0205. Explore career applications of the concept.

STANDARD 3660-03	The students will examine work, describe work concept, and solve related work problems.

OBJECTIVES

3660-0301. Identify and describe the mechanical aspects of work including efficiency, linear systems, rotational systems, and simple machines.

3660-0302. Observe and analyze the fluid aspects of work including efficiency, hydraulics, pneumatics, and pumps/piston systems.

3660-0303. Determine and interpret the electrical aspects of work including efficiency and electromagnetic devices such as motors and solenoids.

3660-0304. Explore career applications of the concept.

STANDARD 3660-04	The students will examine rate, describe rate concepts, and solve related rate problems.

OBJECTIVES

3660-0401. Explore the mechanical aspects of rate including linear rate, angular rate, velocity, and acceleration.

3660-0402. Investigate the fluid aspects of rate including volume flow rates, mass flow rates, and measurement techniques for liquid and gas systems.

3660-0403. Analyze and interpret the electrical aspects of rate including current flow and charge and using the oscilloscope to examine frequency, periods, amplitude, and waveforms.

3660-0404. Observe and evaluate the thermal aspects of rate including heat capacity, specific heat, sensible heat, latent heat, and heat flow rate.

3660-0405. Explore career applications of the concept.

STANDARD 3660-05	**The students will examine resistance, describe resistance concepts, and solve related resistance problems.**

OBJECTIVES

3660-0501. Determine the mechanical aspects of resistance including friction, drag, and lubricants.

3660-0502. Identify and describe the fluid aspects of resistance including laminar flow, turbulence, and identify causes of fluid resistance.

3660-0503. Experimentally analyze the electrical aspects of resistance (including Ohms law, resistivity, and series and parallel circuits, current flow, and charge) using the oscilloscope to examine frequency, periods, amplitude, and waveforms.

3660-0504. Explore and evaluate the thermal aspects of resistance including thermal conductivity, and insulation properties of materials.

3660-0505. Explore career applications of the concept.

STANDARD 3660-06	**The students will examine energy, describe energy concepts, and solve related energy problems.**

OBJECTIVES

3660-0601. Identify the critical elements of mechanical energy including potential and kinetic energy in both linear and rotational systems, and moment of inertia.

3660-0602. Determine the fluid aspects of energy including potential energy in both hydraulic and pneumatic systems, the law of conservation of energy, and the relationship between work and energy.

3660-0603. Explore the electrical aspects of energy including capacitors and inductors, the relationship between work and electrical energy, and electrical generation.

3660-0604. Investigate the thermal aspects of energy including heat transfer, heat and the conservation of energy, and equilibrium temperature of a mixture.

3660-0605. Explore career applications of the concept.

STANDARD 3660-07	**The students will examine power, describe power concepts, and solve related power problems.**

OBJECTIVES

3660-0701. Evaluate the mechanical aspects of power including linear and rotational systems, efficiency, and power applications.

3660-0702. Analyze the fluid aspects of power including constant volume and constant pressure systems, pneumatic systems, and efficiency.

3660-0703. Experimentally formulate the electrical aspects of power including measurement, relationship of electrical work and mechanical work, and efficiency.

3660-0704. Explore career applications of the concept.

STANDARD 3660-08	**The students will examine force transformation, concepts, and solve technological related problems.**

OBJECTIVES

3660-0801. Identify and analyze aspects of force transformers including ideal mechanical advantage (IMA) versus actual mechanical advantage (AMA), and efficiencies of simple machines.

3660-0802. Compare and contrast rotational mechanical aspects of force transformers including IMA versus AMA in a rotational system and efficiency of a simple rotational machine.

3660-0803. Describe and compare fluid aspects of force transformers including mechanical advantage and efficiency of fluid systems.

3660-0804. Observe the electrical aspects of force transformers including mutual inductive coupling and applications.

3660-0805. Explore career applications of the concept.